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MODERN Plastics

VOLUME 17 . MARCH 1940 . NUMBER 7

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C. A. BRESKIN, *Publisher*

E. F. LOUGEE, *Editor*

DR. G. M. KLINE, *Technical Editor*

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ALAN S. COLE, *Genl. Mgr.* . PERRY H. BACKSTROM, *Adv. Mgr.*
M. A. OLSEN, *Eastern Mgr.* . J. M. CONNORS, *Western Mgr.*
HARRIET JOSEPHS, *Associate Editor* . DON RUTHER, *Art Director*
E. R. GORDON, *Production* . R. G. GERMAISE, *Circulation*

April The Ypsilanti Reed Furniture Co. has turned out the most interesting porch and terrace furniture we have seen in a coon's age—using aceto-butyrate plastic (Tenite II) in place of the traditional reed and ratan. The plastic material is extruded, then woven to take full advantage of its translucence and color opportunities and we shall picture a number of the pieces in our forthcoming issue. Methacrylate resins are becoming more and more popular with furniture manufacturers and we hope to include some new tricks with this material in this issue.

ADVERTISING PAGES REMOVED

A TEN YEAR OLD Granddaddy

PIONEERS IN PRECISION MOLDING, RICHARDSON PRODUCED THE FIRST COMPLETELY MOLDED PLASTIC RADIO CABINET, AND THIS WAS LESS THAN TEN YEARS AGO!

INSUROK

The Precision Molded Plastic

Almost unbelievable is the swift and startling growth of plastics, and their widespread application to countless products and processes. Industry, commerce and science have taken these versatile materials in their stride . . . it seems they have always been used. Yet many of today's most intricate molded plastics are possible largely because of precision methods initiated by Richardson ten years ago.

Now, as then, Richardson occupies a position unique in the industry, with unexcelled facilities for the precision molding of commercial plastics to precise tolerances . . . on mass production schedules.

The first molded radio cabinet—a Crosley—was born of Richardson's conviction that it was possible to mold a complete radio cabinet in one operation. This required the development of new processes in mold and die making and advanced molding methods. Illustrated is one of the first cabinets . . . molded of a bituminous plastic . . . weighing 17 pounds, with walls ½ inch thick; finished to match fine cabinet woods.

INSUROK is an exclusive Richardson product. Laminated or molded, it is available in many grades and colors, and in a variety of surface treatments, in parts or completely finished products ready for assembly; or in sheets, rods and tubes for fabrication in your own plant. INSUROK possesses extreme workability and is adaptable for plastics uses where known physical, chemical and dielectric qualities are essential. Consult Richardson technicians about any present or contemplated use of plastics. No obligation.

Advanced molding skill is apparent in this present day precision molded INSUROK RADIO CABINET, produced by Richardson for Belmont Radio Corporation. The walls are ⅛ inch thick; the weight approximately one pound. Striking in design and beautiful in appearance, INSUROK radio cabinets are available in a wide range of colors and finishes. No surface treatment is required; they are ready for use as they come from the molds.

RICHARDSON PRECISION PLASTICS

NOTIONS

The RICHARDSON COMPANY

McGraw Park, (Chicago) Ill. — Lockland, (Cincinnati) Ohio
New Brunswick, N. J. — Indianapolis, Ind.
Detroit: 4-252 G. M. Building. Phone, Madison 8388 — New York: 75 West Street. Phone, Whitehall 4-4487

MODERN PLASTICS

MARCH 1940 VOLUME 17 NUMBER 7

Illuminated Sign Display

by ROBERT L. DAVIDSON

In which plastics provide economies in operation and permanence

SIGNS! Signs—everywhere! Flashing their individual advertising message. Inviting, cajoling, urging, admonishing, commanding—in competition with one another. That's the American way of life, and whether or not we take particular notice of those signs, they exert their influence on our daily lives more than we suspect.

The use of plastics in sign display illustrates the universal adaptability of the plastic field to the widespread requirements of this type of advertising. Not only is there a material for almost every need, but the processing of these materials embraces the industry. Today, awaiting the needs of the manufacturer of illuminated signs, are stock items in molded, cast, and laminated plastics which can be tooled, jigged, and assembled into any number of ingenious effects. And sign manufacturers have responded to this opportunity. They have utilized these materials, decorating the boulevards and the shop windows with thousands of illuminated displays glowing in all shades of the spectrum.

The success of an illuminated sign is gaged by two factors—attention value and cost. Under attention value, there are such qualifications as size, location, copy appeal, and beauty, the last of which finds an undeniable virtue in plastics. But cost! Ah, there lies the rub. The consensus of opinion has it that plastics

1

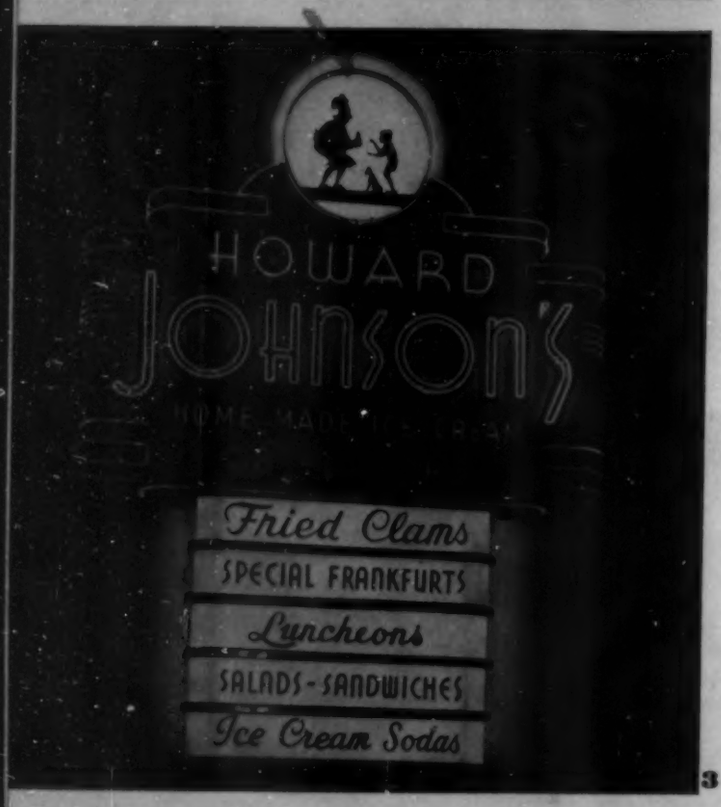
With 96 Lustron interchangeable letters, House of Java can change its menu copy 1, 4 times a day for 32 days without repeating a message. Catalin bases support the neon lighting element

2

are much too expensive, actually out of sight when it comes to a practical application in illuminated signs. This is seldom the case, however, when all angles have been considered. True enough, the initial investment is often more than it would be with non-plastic materials, but the original cost is but a fraction of sign expense. Maintenance of the sign is probably the greatest financial item because it not only involves the continued use of the location, but the electricity and upkeep as well. The life-span of the sign, both physical and psychological, must also be considered. The actual weathering of the sign may be perfect. Physically it may wear *forever* like the horsehair sofa, yet be equally out of date from the psychological point of view, in which case the money expended for permanence would be wasted. Consequently, flexibility becomes a point of consideration. Will the sign be flexible enough to permit frequent copy change or general refurbishing?

The *House of Java* sign (Fig. 1) made of lustron tubing exemplifies this quality of flexibility. The individual letters on a base of cast resin are removable and can be placed in any order on the contact *trolley* thus allowing copy themes to be easily and frequently changed. Lustron is low voltage neon and consequently will not heat up, but operates on a beam within the wireless range so that a metal mount would not only act as an antenna causing radio interference, but would absorb so much of the voltage as to necessitate a high temperature in the tubing for sufficient light, therefore defeating its entire purpose. As is, the cast resinous mount not only holds the tubing and acts as an insulator, but it adds appreciably to the appearance of the sign as well.

There is a light diffusing quality about some plastics that makes them especially applicable to illuminated signs. Both urea and phenolic in translucent laminated



3

Easily readable, day or night, this Lamicoid sign **2** of Mica Insulator Co. is economical to build and install. Howard Johnson's sign **3** is of the same material and shows how it can be bent at corners. The Nickel Plate R. R. sign **4** and the Reid-Murdock Co. Lion **5** lights up with realistic depth on a urea laminate, called Insurok

4

5

sheets seem actually to absorb the light—almost like a blotter—distributing it evenly over the entire surface which results in a uniform glow with a minimum of *high-spots*. Naturally this quality of diffusion aids substantially in the maintenance costs of the sign since the plastic face requires but a fraction of the wattage ordinarily necessary for the proper illumination of such a display. For instance, the Mica Insulator Co. has a sign (Fig. 2) 54 ft. long and $3^1/_2$ ft. high over its plant at Schenectady, N. Y., made from translucent sheets of a laminated phenolic. The background has been painted in with an opaque color and the entire sign illuminated from behind. Only 31 10-watt bulbs are required for this job. *One-tenth* the amount of electricity that would have been used on an ordinary bulb-outlined sign of the same proportions. Another interesting feature is the distinct readability and appearance during the day when the sign is not lighted.

Howard Johnson's has utilized the same material to supplement the neon and metal sign (Fig. 3) at its Wollaston Beach, Mass., restaurant. Here a reverse order was used with the background translucently lighted, upon which opaque letters had been painted. The thickness of the laminate was graduated to allow for easy bending at the ends and to insure rigidity around the center, the center being $^{80}/_{1000}$ of an inch thick while the ends are only $^{20}/_{1000}$. This is one-fourth as thick as glass would have had to be under the same circumstances. Considering the breakage expense with glass, this plastic is less expensive, and despite the severe climate of the shore, the sign has shown no appreciable weathering deterioration over the past two and a half years.

Plastic laminates are especially useful in displays and custom jobs where small quantities are involved. They can be painted upon, blocked out, sawed into any shape, glued, and are obtainable in nearly every shade of color. They serve as excellent backgrounds even when the lettering is made from a different medium and suspended in front of the plastic, as in the case of the rear-end sign on the Nickel Plate R.R. (Fig. 4).

Here a translucent urea laminate $^1/_8$ in. thick is framed in metal, illuminated from the rear giving a three-dimensional effect to the metal letters which are placed some distance from the background. Previously $^1/_2$ in. plate glass was used. Breakage replacements were frequent and the change to plastic cut 53 lbs. off the sign's weight.

An illustrated illuminated sign can be effectively achieved by painting with opaque and translucent paints on the surface of a sheet of laminated urea. The light diffuses through the various shades creating an almost stereoscopic effect of depth (Fig. 5).

Carrying this quality of light diffusion from the laminates to the cast and extruded plastics we discover that the old-fashioned *button-light* has returned with new beauty and added advantages. Today, glass *reflector* buttons are still used in roadside signs. They used to be prevalent, however, in lighted displays where the buttons would be inserted in (*Please turn to page 70*)

6

Lucite buttons on Havana's Tropical Club sign **6** give the realistic appearance of lighted lines. Being entirely transparent and clear, the light of the sign may be white or, if the buttons are colored, the light will be colored too. Yellow Catalin buttons give a pleasing mellow glow to this U. S. Royal indoor sign **7** which is lighted from within. Awarded Honorable Mention in MODERN PLASTICS' 1939 Fourth Annual Competition, these were fabricated for L. H. Philo Corp. by Automatic Button Company

7

These radios were among those entered in MODERN PLASTICS' Fourth Annual Competition. Air Pal, directly above, molded of Permo by General Industries Co., won Honorable Mention

Small Radios—Today and Tomorrow

Are plastic radio cabinets on the way out—or, will more sensible design permit them to continue to accelerate sales?

THE president of a radio manufacturing concern was discussing plans for 1941. Spread before him on a huge walnut desk were sketches and colored drawings of console and table models ranging in wholesale price from five to one hundred dollars.

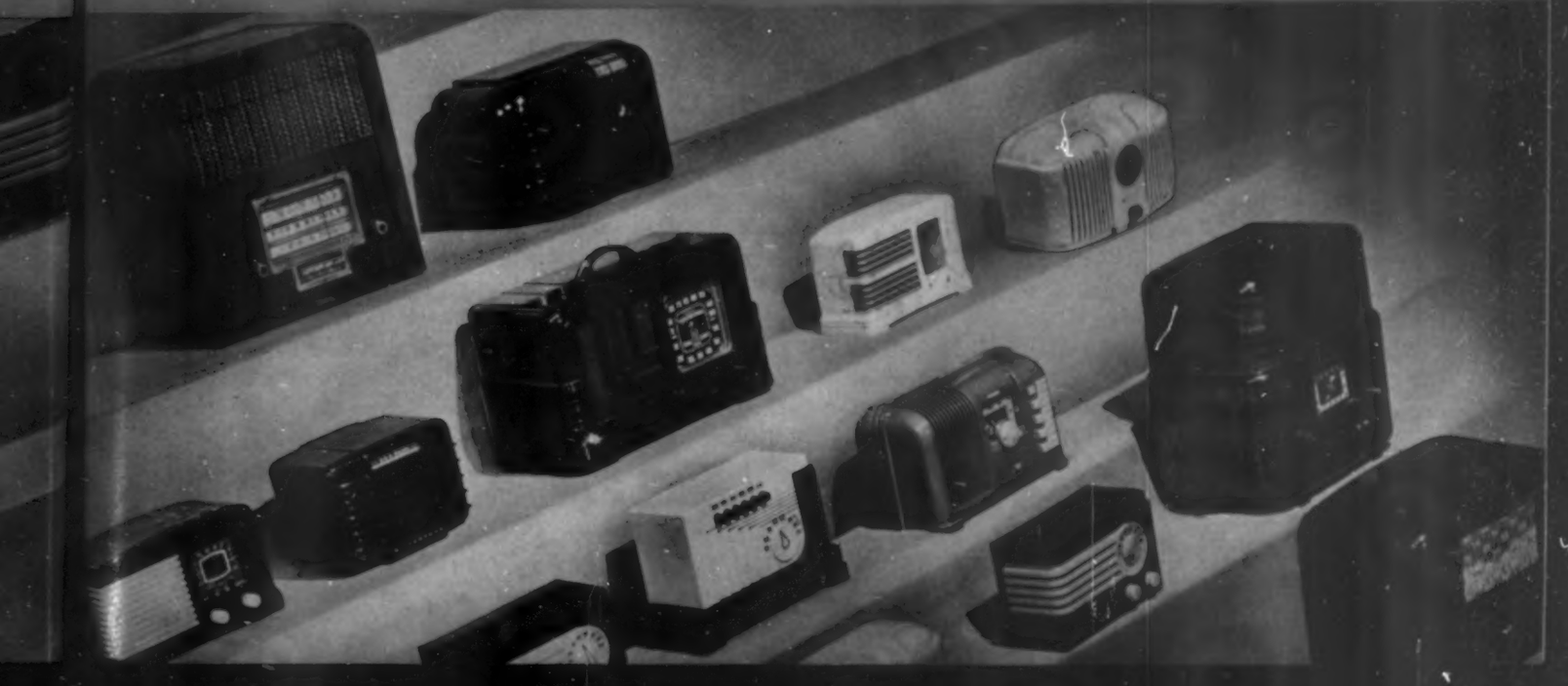
Facing him, at the other side of the desk, sat his production and factory manager; while at his left, looking over his shoulder, his salesmanager stood with one elbow resting on the back of the boss' high back chair. The salesmanager was speaking.

"I still believe that our table models, especially in the low-price brackets, should have plastic cabinets. Color is still....."

"They don't stand up," interrupted the president, "and you, more than anyone else, should know that.

"Look at our return sheets for—for 1939," he continued taking a black covered book from the top drawer in his desk. "More than 6 percent of Model LK-90 and nearly 10 percent of B-84 came back with cracked shells. Do you call that good merchandise? Both of those numbers were in plastic cabinets."

"We had a better percentage of returns than



Most recent Kadette (above) represents a departure from established cabinet construction. Molded of ivory Beetle and walnut Durez by Firestone, it was designed by Barnes & Reinecke. Below is a Bakelite urea cabinet molded by Gorham for Automatic Radio Mfg. Company

either of those on LV-60 and 67," broke in the production manager. "Those were the veneer cabinets and you will recall that many of them went sour in the South and West where it is too hot and dry for anything short of asbestos and steel."

"Plastics weren't so discriminating," said the president sarcastically. "They went sour wherever they were shipped."

"But we sold more plastic sets than all the others put together," asserted the SM. "And that's where our competition is going to be this year—stiffer than ever. Furthermore, that's where our profits were made last year—returns or no."

And so they argued.

The salesmanager was fully convinced that color sells radios and that plastics are destined to play a big part in their immediate and future sales. And he knew, too, that without them, his sales would slump.

The production man was sure now that if they had followed the advice of the molder who made the cabinets, they wouldn't have cracked. He told them the design was bad for a molded job—that it was practically impossible to make the material flow around certain decorative louvers which had been designated in the original design.

But the president wouldn't listen to a change in the mold, which meant spending a thousand dollars more before production got under way. The salesmanager was with him. He liked the design and wouldn't agree to change it. So returns were inevitable. The cabinets all cracked in the same place, the weak spot in the design of the model.

The thing that the president didn't know, or at least hadn't taken into consideration, is the fact that small plastic cabinets for radio are rapidly gaining in popularity with consumers everywhere and enough of them are being made and sold to convince the most profound critic that if they are designed properly, they stand up and give satisfactory service throughout the life of the average set.

During the first six months of 1939 there were 10 percent more plastic sets sold than during the entire twelve months of 1938.

Figures released recently by *Communications*, a publication devoted to the radio industry, reveal that plastic cabinets have so rapidly gained in popularity that they are used in more than half the table models made.

They follow:

	Total sets	Table Models	Plastic Cabinets
1937	7,405,000	3,580,000	904,000
1938	5,880,000	3,575,000	1,420,000
1939*	4,482,000	2,952,000	1,570,000

* 1st 6 months only

It is true that plastic cabinets sometimes crack. They burn, too, when the heat of five or more operating tubes is closely confined in a space obviously too small and without proper ventilation.

But is that the fault of plastics?

We believe not.

It is often the fault of the manufacturer who uses the *penny* as his only measure of cost. That penny becomes so big and so important in his plans that he fails utterly to see the dollars that must be wasted later on in replacing cabinets that go bad.

Another contributing cause is the manufacturer's lack of understanding of the physical characteristics of plastic materials. What they will do under prescribed circumstances. How they will behave under extreme conditions. Failure to recognize these simple limitations and avoid creating demands which cannot be met with any degree of assurance, have been responsible for whatever dissatisfaction has arisen in the field.

In considering designs for new cabinets, it is important to distinguish between design for *appearance* and design for *production*. They are equally essential to the success of the cabinet but since they are likely to become controversial between the sales department and the production engineers, the final result is sometimes a compromise through which unwarranted sacrifices are made.

Design for appearance is limited to the outer surface and contour of the cabinet while engineering design must provide proper wall thickness to prevent swelling, shrinking, cracking and other distortions during the molding period or under ultimate service conditions. Engineering design must also provide means for rapid assembly and determine the location of bosses, ribs, struts, slots or other openings so that the plastic material will flow properly in the mold and weld without leaving mold marks or weak spots likely to separate later on when exposed to atmospheric conditions with resulting natural stresses in every day use.

Engineering design also must determine the location of tubes within the cabinet if light colors are used so there will be no danger of overheating the material at points which will cause it to discolor or shrink to the point of breakage.

Design for appearance, unfortunately, must bow to these limitations if anything like a successful plastic set is to emerge for public pleasure and entertainment. But the limitation is not as great as it might seem to be in this bare statement because plastic materials themselves are flexible in their behavior and can be made to specifically meet many unusual demands if these demands are clearly stated in advance of the choice of material is made.

Plastic materials can be made to have different degrees of flow and one suitable to buttons would hardly produce satisfactory results for some entirely different type of product.

This point is often overlooked by designers. They turn out a good-looking design but it means that the plastic material must squeeze through orifices and go quite a long distance before coming together again where it must weld—leaving no evidence of doing so.

This is particularly evident in current models where louvers are molded integrally with the cabinet.

In planning such a cabinet, there are many factors which should be considered—length of flow, time of flow, rate of cure, rate of set—before the design of the model is finally approved.

It is difficult to know whether a crack is going to be the result of too thin a section or faulty mold design, or faulty operation of the mold. Each of the plants engaged in molding has a prescribed set of conditions. And the operator doing the work may not adhere to them. The molder, however, if allowed to construct the mold according to his experience and knowledge of the materials he is handling, seldom turns out cabinets that crack.

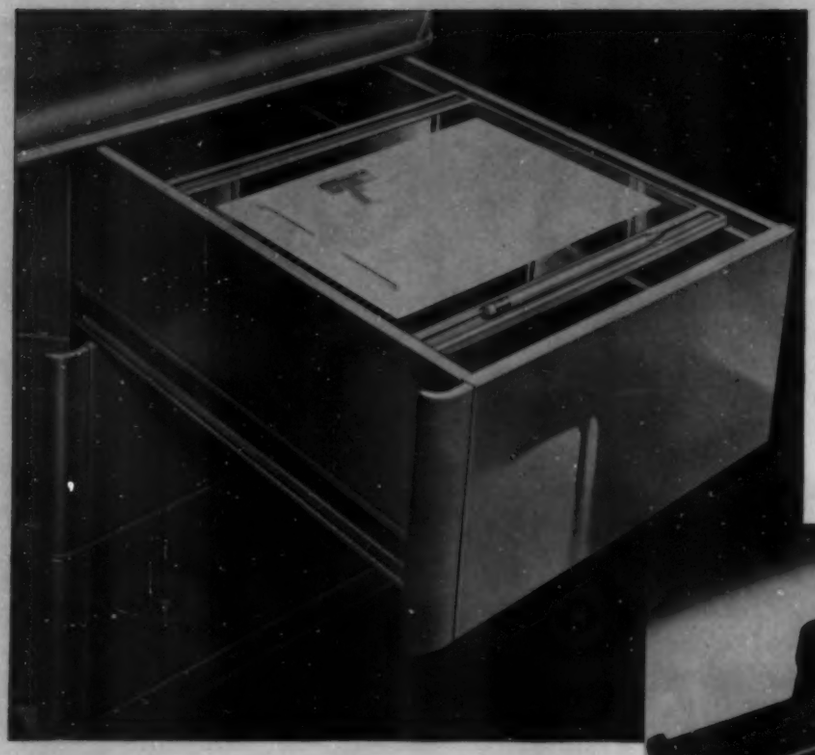
It is only when he listens to the dictates of the penny-wise manufacturer and against his best judgment accepts an order to turn out cabinets which he knows, or suspects, will not stand up, that trouble begins.

Fortunately, this type of molder is gradually eliminating himself from honest competition. Even the penny-wise manufacturer learns eventually that plastics will make radio cabinets that sell and return a profit if wisely planned and *properly engineered*. He learns, too, that he can't get his pound of flesh by cutting a pound of material from the proper wall thickness and stability of the cabinet itself—even for the wishful saving of fifteen to thirty cents.

How, then, can a manufacturer be assured of getting a plastic cabinet that will sell and stand up?

(Please turn to page 80)

The new Silvertone (Sears-Roebuck) above, is molded of brown mottled Durez by Firestone. Below, you see two modern General Electric radios designed and molded by the General Electric Co. using Plaskon urea



Security Steel Equipment Corp. turns out this modern desk with Beetle handles molded by Boonton Molding Co. One of the molded pieces, showing the method of attachment, is pictured below

Hidden Handles

A FAR cry from the massive "roll-tops" with their complexity of cubby-holes, ornate brass handles and heavy cumbersome drawers, the modern office desk has been whittled down to a size that provides maximum working efficiency and smart appearance—and fits within the limited floor space allotted in the average busy office. Design trends have been toward simple, smooth, "work-flow" lines. Comfort, convenience and functional practicability go hand-in-hand with the demand for durability and economy. Colors and materials must blend with other equipment.

With these principles in view, the Security Steel Equipment Corp. of Avenel, New Jersey, has designed a new line of steel desks, called "Administor"—planned for active service, inside and out.

Inbuilt appurtenances and accessories facilitate organziation for work and control. A combined posting writing-reference slide replaces conventional sliding shelves. Drawers may be transposed, equipped with various partitions, or exchanged for a device to hold typewriter, filing and stationery compartments.

Desks are finished in a dull gray. The neutral tone blends with any decorative scheme and the gray working surface reduces eye-strain by minimizing glare and by avoiding extreme color contrast between paperwork and the desk-top.

Flush and symmetrical, the chassis of the desk is well balanced, thereby improving rigidity and appearance. Set-back stancing allows easy cleaning below and around corners, regardless of desk grouping. All contours are gently rounded. There is no protruding paneling or top overhang. Projecting hardware is eliminated by the use of concealed, *inbuilt* plastic push-pull grips. These are attached to the innermost section of the desk drawer, forming a smooth unbroken line on either side of the kneespace.

This logical arrangement permits opening and closing of any drawer with a functional directness that is automatic and does not require the usual visual seeking for the ordinary type of handles. A vertical recess behind the drawers allows easy access to the grips, eliminating annoying and time-wasting groping. The handle is quickly recognizable to the touch because of the warm, smooth feel of the plastic.

Practically invisible at first glance, the handles are molded of urea-formaldehyde in a deep gray matched perfectly to the dull tone of the steel. Rigid, lightweight, and chip-proof, they (*Please turn to page 82*)

Resins for Closure Efficiency

by G. C. MILLER*

Composite liners depend on synthetics for cleanliness and effective seal

PLASTICS enter the cap and closure field from many converging sources. Artistically designed and colored, molded plastic caps are important sales advantages and are being used on more and more products. From another source comes resin-coated paper and foil, which have already assumed an extremely important role. It is now estimated that over 30,000 products are being packaged with resin-coated paper liners—waxed and unwaxed, and in screwed metal, crimped metal and molded plastic caps. Of the several elements of a closure, the liner is decidedly the most important to a good seal. That "the liner makes the closure" is far from an understatement.

The usual liner is a disk consisting of the liner paper proper backed with a resilient material, the liner paper proper being in contact with the product being packaged and the lip of the container. The resilient backing compensates for slight irregularities in the glass or metal surface, and retains the compression of the liner against the jar or bottle in case cap pressure might otherwise be lessened due to temperature changes. When a cap is turned or screwed into position, the liner must slide easily over the glass. In addition, after storage and when the bottle or jar is opened, the liner must not stick or hinder removal of the cap.

Chemically, the principal duty of a liner is to protect the product from contamination. The liner must in no way either affect the product or be affected by it. Complete inertness is mandatory for long periods of time. Unused closures must have long storage life, and liners must retain their desirable properties under sometimes very unfavorable conditions.

To meet all these requirements, many liners consist of resin-coated paper bonded to a suitable backing material. The paper best for the purpose is 3.5 mils in thickness and is coated with a 2.0- to 2.1-mil layer of resin. The resin, the copolymer of vinyl chloride and vinyl acetate, is calendered onto the paper under heat and pressure. The backing material depends upon the type of closure needed, but is generally cork, newsboard or pulpboard. Coated liners are supplied both with and without a waxed surface on the resin coating. Wax-coated paper gives somewhat lower moisture-vapor transmission.

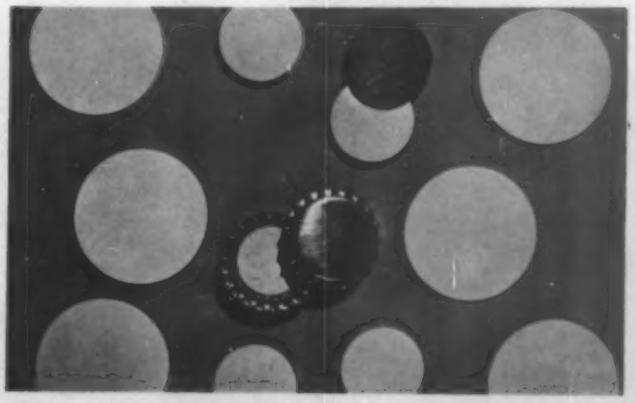
Liner material consisting of these elements is furnished either in strip form so that liners can be punched and inserted into molded caps by automatic machines, or individual liners are furnished ready for use, punched to any one of the 105 standard liner sizes. They are then inserted by hand.

It is estimated that about 50 percent of food and pharmaceutical products, which are now being packaged in glass, are sealed with resin-coated liners. Such composite liners supersede black and yellow varnish papers and a number of other materials. They have been found suitable for use with practically all food or pharmaceutical products except those relatively few which contain ketones, organic esters or chlorinated hydrocarbon solvents. The resin coating is resistant to acids, alkalies, oils, alcohol, gasoline and moisture, and it has reduced moisture loss to a minimum in many packaged products. Other advantages of the resin are a complete lack of odor or taste, a clean, white, sanitary appearance and complete freedom from any change or deterioration on storage. So inert are these liners that they have even replaced foil for closures for carbonated beverages and liquors. Their versatility of use has enabled users to reduce liner inventories to an attractively low figure.

Composite liners of this type are in general use throughout the food, pharmaceutical, and cosmetic industries. In some cases, however, variations are used. Foil coated with vinyl resin is sometimes bonded to cork to form a liner of essentially the same characteristics. In special instances, liners are being made of the vinyl resin sheet itself, sometimes formed to fit particular packages, especially for certain cosmetics.

These typical closure liners consists of Vinylite resin-coated paper bonded to pulp board and cork

PHOTO, COURTESY IRVINGTON VARNISH & INSULATOR CO.



* Carbide and Carbon Chemicals Corp.

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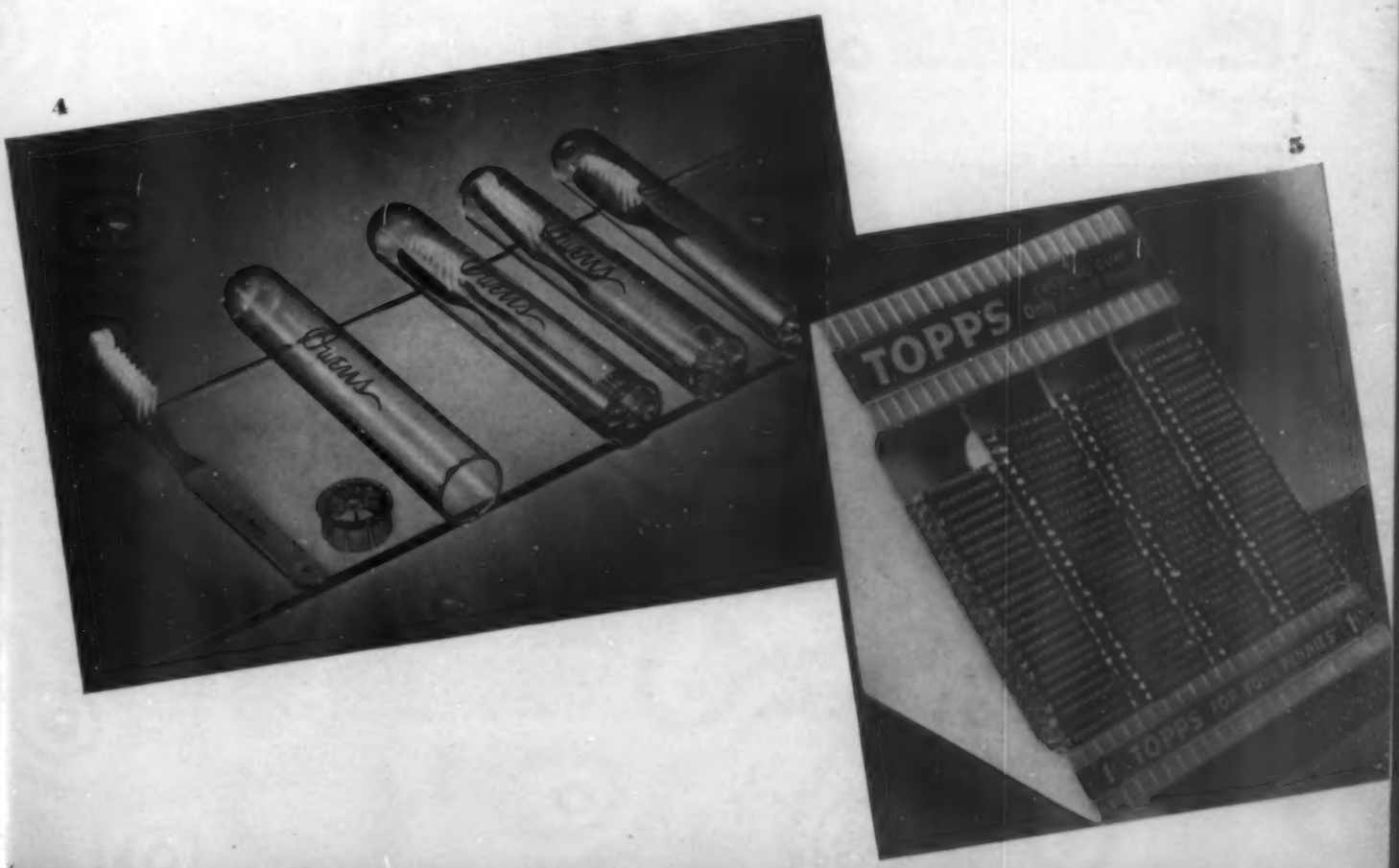
2

3

HONORED BY ALL-AMERICA PACKAGE COMPETITION

Award winners in the Plastic Container Group of the 1939 All-America Package Competition, sponsored by *Modern Packaging* magazine, are: The molded box (1) in which the Blackhawk Mfg. Co. merchandises its "Torkflash" tension wrench. Sturdy, attractive and convenient to use, the molded box convinces purchasers that it is designed to protect a real precision tool. The Blackhawk Mfg. Co. collaborated with Eclipse Molded Products Co. in designing the package, using red Durez for the lid and black Bakelite for the box itself. (2) The plastic molded display packages for Gruen watches that can be handled continuously, cleaned quickly, yet display the delicate, precision merchandise to the best advantage. A special molded hinge eliminates the necessity for metal hinges and catches which so frequently mar a box of this kind. Gruen designed the box which is molded of Plaskon by Rathbun Molding Corporation. (3) The plastic container used by Nicholson File Co. to display and sell files. The molded box which holds files in an upright position where they are easy to select and return, has a molded cover which protects the files and appeals to the natural pride of the craftsman in his tools. John Hedu designed the container which is molded of Tenite by Watertown Mfg. Company. (5) Topps Gum counter display won honors in the Counter or Shelf Displays group. Karl Fink was the designer and the Bakelite molding was done by Accurate Molding Corporation. Ivory and black are the colors. (4) This toothbrush holder is made of glass and the transparent plastic closure is constructed to allow for the slight variation in diameter found in unthreaded vials. Therefore, it can be used to seal the package until sold and provides a convenient closure for the package during use. The closure fits inside the walls of the vial and is slotted in eight places so that the resilient plastic material can allow for the varying tensions imposed by the package. Tenite II is the material used and Owens Illinois Glass Co. did the molding. Chief Engineer Conrad Tabst designed the package. Kimble Glass Co. made the vial.

There are many other closures among the winners in the All-America Package Competition which are pictured and described in the March issue of *Modern Packaging* magazine. We chose this one to present because it is the first of its kind.



From A to Z

Molded letters, in complete sets of various sizes, are available at little cost

THE noonday luncher who twines his legs around a stool and stares hopefully at the *Today's Menu* sign on the wall back of the counter, seeking an antidote for a certain inner emptiness, may not notice anything different about the sign. He has probably studied it from top to bottom many, many times before. If he is an observant sort of person, or a stickler for cleanliness in all things, it is entirely possible that he appreciates, subconsciously, the gleaming whiteness of the letters that stare back at him, their stark simplicity and easy readability.

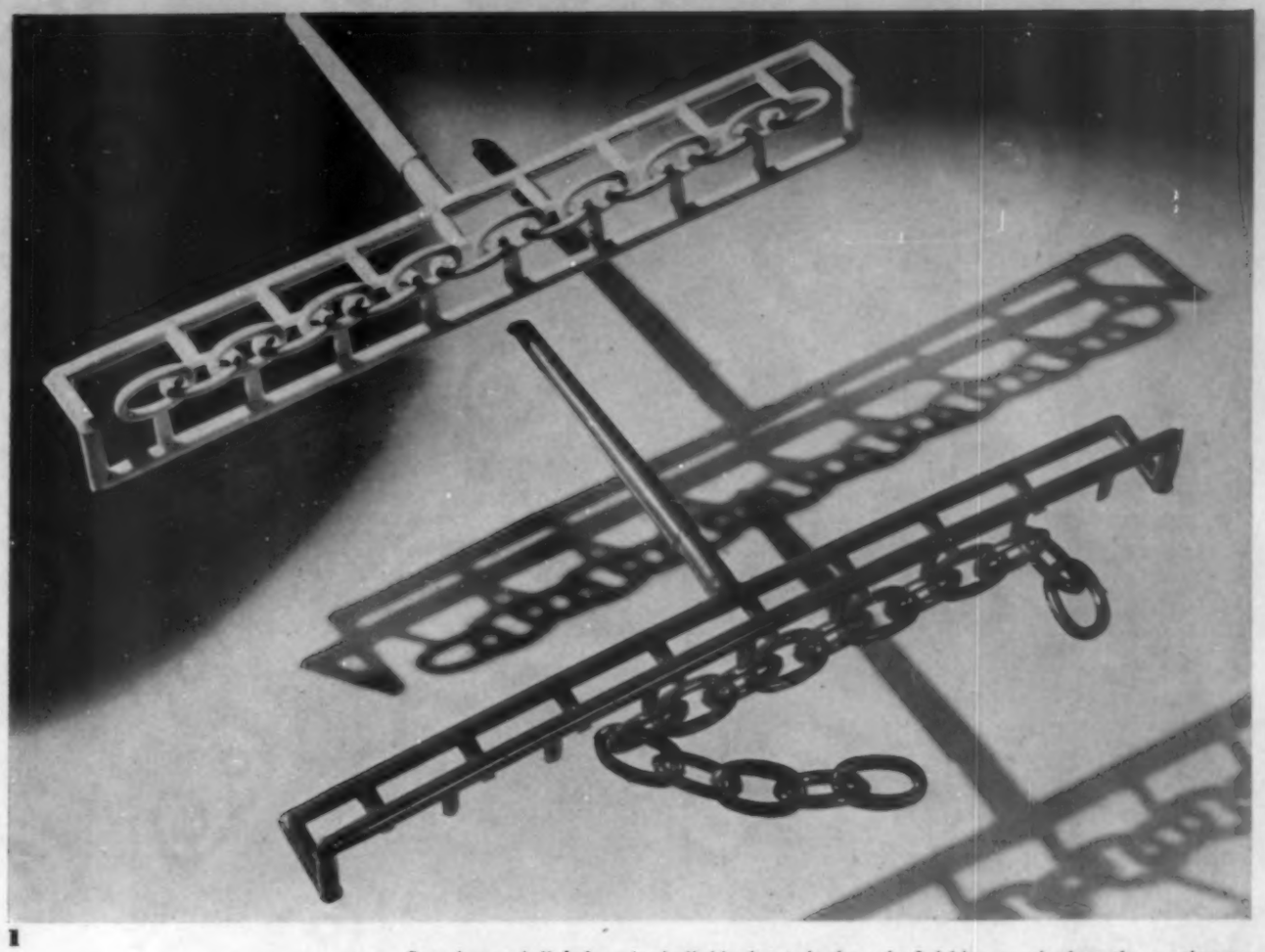
There is a difference, though, and it goes far beyond mere neatness. For in modern restaurant and lunchroom signs, the letters that spell out *split pea soup* or *ham and eggs* or *apple pie and cheese*, have gone plastic.

Of course, there is nothing particularly sensational about plastic letters. Machined from cast phenolic resin blanks in all sizes and colors, they are a familiar sight on store window and counter signs and on displays of one kind or another. But, to our knowledge, this is the first appearance of cellulose acetate letters produced by injection molding for changeable signs.

The molded plastic letters, so we are told by those who should know, are a decided improvement over the flat or embossed enameled metal type that have carried on for so long. For one thing, they are more economical. The hopper of the injection press is filled, the operating mechanism released and at regular short intervals, out pops a sprue of perfectly formed letters, ready to be broken apart and packed for shipment. Because of this rapid method of production, the molded letters cost no more to begin with than those they replace. The purchaser doesn't have to throw out his present supply and start fresh with a plastic alphabet, for the molded letters are designed to match all popular lines of embossed letters, and for economy's sake, can be used harmoniously with left-overs from the metal version. As for fill-ins—well, the heavier, stronger, non-flammable molded plastic letters wear so much longer than other types, that replacements are claimed to be few and far between.

The plastic letters are molded with neat, rounded wings at top and bottom which fit perfectly and securely into display board grooves. There's a large size for special emphasis ($1^1/_2$ in. high) which covers six grooves in an ordinary display board; a medium size for next-important listings (*Please turn to page 82*)

Molded of Monsanto cellulose acetate, these letters are available in sets, or in bulk, from the Butleroid Division of Commonwealth Plastics Company



1

Severing each link from its individual gate is the only finishing required on the continuous chain 1, injection molded of acetate at a single stroke. Usual operations of shaping, cutting, threading, cementing and polishing are eliminated by ingenious mold design

Two Aspirins Please

Mold maker's headaches are never included in the cost of the die

IT IS probably just as well we can't see the inventive mind at work. Mental gyrations and cerebellous acrobatisms would be fantastic to watch as they spring into action when a modern mold maker is confronted by some of the demands for plastics production.

A mold maker is not in the plastics business. He has no part in the manufacture of plastic materials. He has nothing to do with turning these materials into useful products. Yet he has everything to do with the manner and technique by which they are turned out. For it is through his skillful manipulation of steel and tools that workable dies, or molds, are made. Without them, plastics could not be molded.

It is his problem, therefore, when a product has been designed, to plan, engineer and produce a mold which will deliver that product in sufficient quantities to meet specific demands. And turn them out with as little lost press time as possible; with a minimum of flash or wasted material; without sticking; with adequate channeling to heat or cool the mold properly; and with a surface that requires no polishing or finishing after it comes from the mold.

It is comparatively easy for a mechanical engineer or an experienced mechanic to reproduce almost any object in metal. It is merely the matter of proper equipment, effort and time. It is relatively simple to do this in reverse. That is: Cut the object into a block of steel instead of cutting it out of a block of steel. But there is more to mold making than that.

The cavity, or multiplicity (*Please turn to page 76*)

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plastics for interior design

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FROM baseboard to ceiling—for small home or skyscraper hotel—on land and at sea—laminated plastics have become the Number One choice for colorful, enduring, decorative surfaces. By leaps and bounds, the use of this modern finishing material has grown familiar in the interior design sphere, and new developments in colors, materials and processes point the way to increased applications for home and building construction.

The decorative flexibility and versatility of these laminated plastics, which designers, decorators and architects have been quick to perceive, is represented in recent installations from coast to coast. Taking full advantage of the richness and utility of wood grain finishes, John Knipp and Sons selected a prima vera grain for the bar and table tops in the Lounge Riviera (Fig. 4), Washington. The entrance door (Fig. 1) is a lacewood finish with inlaid crest and letters. The same material lines elevator cab interiors (Fig. 2) at the Hotel Allerton, Chicago.

Impervious to hot or cold water, steam, cosmetics, medicines or other liquids, a laminated plastic wall inlay strikes a smart, sophisticated note in the bathroom (Fig. 3) of a modern home which was designed by Gunnar Peterson.

Bars and restaurants recognizing the sales value of attractive surroundings and demanding material that requires little upkeep, have made extensive use of laminates for table and counter tops, bar fronts and backs. The cocktail lounge at the Hotel Shoreham, Washington (Fig. 5), matches plastic surfaced tables and bar in blue and gray to a ceiling of similar laminated material. Inlaid panels, wainscoting, bar front and monogrammed table tops of harmonizing laminates highlight the Earle restaurant, Washington (Fig. 6), designed by John Eberson, theatrical architect. These long-wearing, sound-deadening colorful materials top tables in the lounge (Fig. 7) of the Hotel Nixon, Butler, Pa., and in the tourist smoking room (Fig. 8) on the steamship, *S. S. Mauretania*. An installation by John Weiss for Hill's Dinette, Milwaukee (Fig. 9) illustrates their application for curved counter tops.

Figure 10 pictures an interesting, serviceable utilization of plastic surfaces for show case fronts and basing, flush with the floor, in the large Read's Drug Store, in Baltimore. (*Please turn to page 74*)

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ALL PHOTOS, COURTESY FORMICA INSULATION CO.

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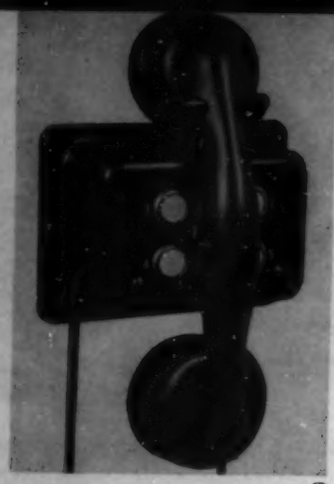

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1 Gruen has redesigned the gift-display packages for its new line of watches. A vivid, deep-toned blue brings out the simple pattern and sets off the jewelry. Boxes are molded of Plaskon by Rathbun Molding Corp. and are fastened with a special spring hinge patented by the molder

2 Tapping the market for private intercommunication equipment, Automatic Electric Co. offers the Idealfone, a push-button telephone unit, available in systems of two to ten stations. Full-size, nine-inch handsets are of Bakelite molded

3 Practically unbreakable, clear Plexiglas lenses are used in two new models of Willson Safety Goggles. Reported tests indicate that in arc welding, these plastic lenses stand up longer than glass, since hot metal particles tend to cling to glass and pit the surface, but have little effect on the smooth acrylic surface

4 Novices can make music with the Symphonette, a flute that's as clear in tone, black and satin-smooth as a professional "licorice stick." Watertown Mfg. Co. injection mold the instrument of Lumarith for Carl W. Vandre

5 Traffic Torch—consisting of a threaded red translucent Lucite tube attached to a standard flashlight base—is an effective safety aid, especially on dark nights and in stormy weather. When the torch is lighted, the acrylic tube gives off a penetrating red glow, readily discernible by approaching traffic

6 Pebbled finish on these Sportster field glasses adds smartness to appearance and improves finger grip. They are lightweight, sturdy, and come in one- or two-tone effects. Cases are molded of Tenite by the Richardson Co. for Lan-Dee Mfg. Company

7 Combination of richly colored and fine-grained wood veneers with a foundation of Masonite quarterboard, forms the figured wood paneling in the directors' room of that company. This wall material is light in weight, easily handled and can be installed with regular carpenter's tools. Panels are flat, come in thicknesses of 1/4 in. and less, and in various sizes and veneers

8 Four of a kind—Novel-Craft Chip-Tray set fits 100 red, white and blue poker chips in separate molded Durez ash trays, holding 25 assorted chips each. Chips are of casein made by American Plastics Corporation

9 Slide back the cover and cigarets pop up firm and uncrushed from individual compartments. Designed for one-handed operation, colorful cases are injection molded of Plastacele by Sobenite, Incorporated

plastics in review

10 Sporty plastic boxes and the well-known 8-ball contain accessories made by Pioneer Suspender Co. These dual-use packages are molded of Bakelite phenolic by A. L. Hyde

11 Every day now plastics are finding more and more interesting applications. This Miss is clothed (or is she) in a beach ensemble of Santoglass, a film-like plastic which is resistant to moisture. The material, produced by Monsanto Chemical Co., becomes completely transparent when laminated between two surfaces of glass and is usually used in making safety glass for modern cars. If the young lady ever finds herself under such circumstances, we hope we are around

12 No more entangling alliances with electric cleaner cords—the Cordomatic handle device automatically maintains definite lengths of cord in use and reels it in when cleaning is finished. Inset shows the self-insulated molded Durez reel section. The unit, marketed by Vacuum Cleaner Corp. of America, will interchange with almost any handle

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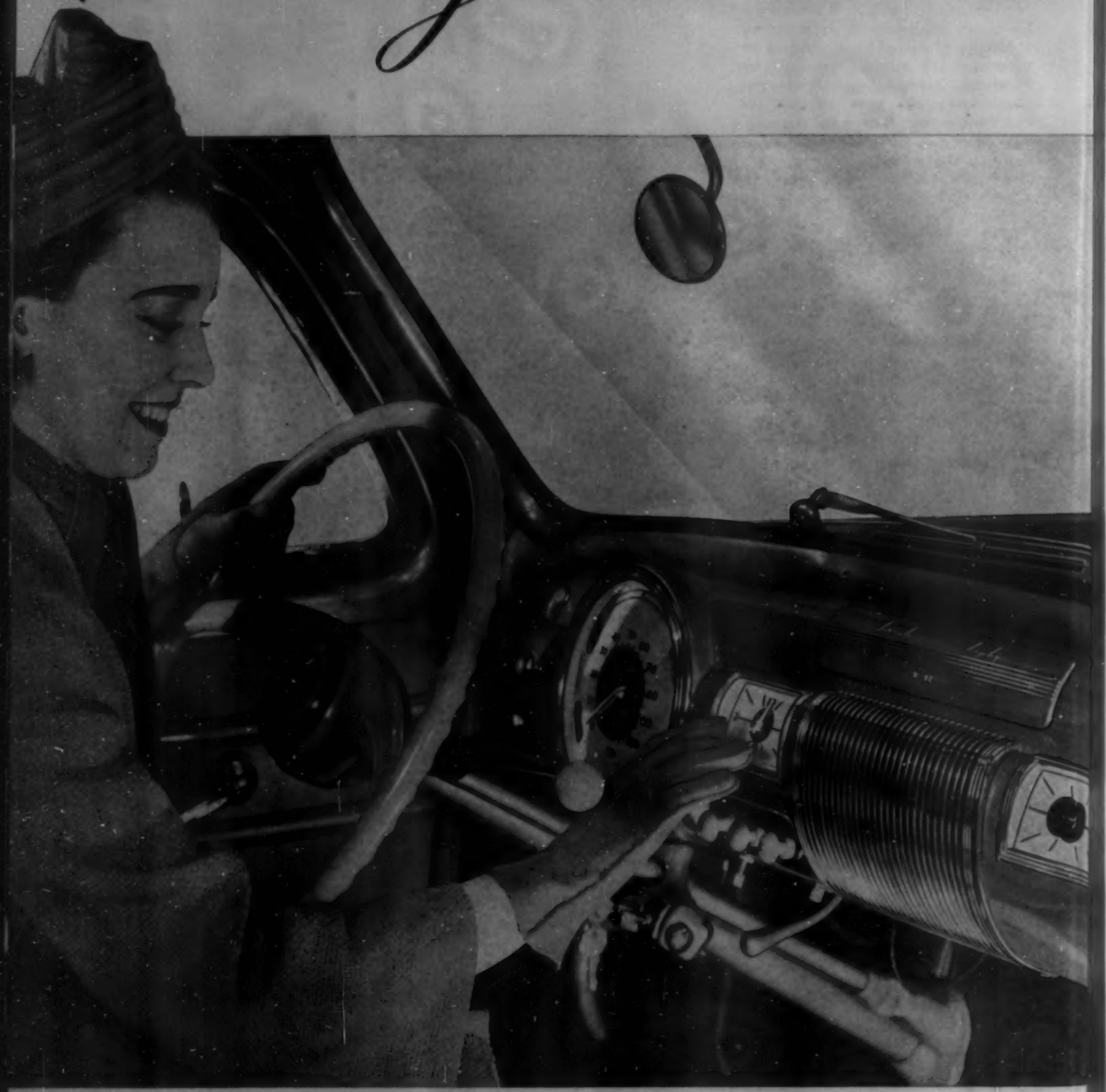
"It's lovely!"—it's in the



Completely in keeping with the sleek exterior styling of the Lincoln-Zephyr V-12 is this sparkling instrument panel. The faces of the ash receptacle, clock and dial assembly lend a smart note of contrast and distinction to the interior appointments. Molded Plaskon was chosen for these applications by the Lincoln Motor Company, division of Ford Motor Company, because it so completely meets the quality specifications demanded for Lincoln-Zephyr V-12 manufacture.

Lincoln-Zephyr

● Whispering past you in the street, this is the car you swing around to watch in wide-eyed admiration.

So sleek . . . so beautifully designed . . . so different in every detail. Yes, let's study some of the appointments that make the Lincoln-Zephyr so distinctly handsome.

Here's the glistening instrument panel, like a jewel box framing its rich treasures. Notice the ash receptacle, the clock, the dial assembly. Those mellow ivory-toned faces are Molded Plaskon . . . the modern plastic chosen for its ability to reflect fine character and beauty upon any product with which it is associated.

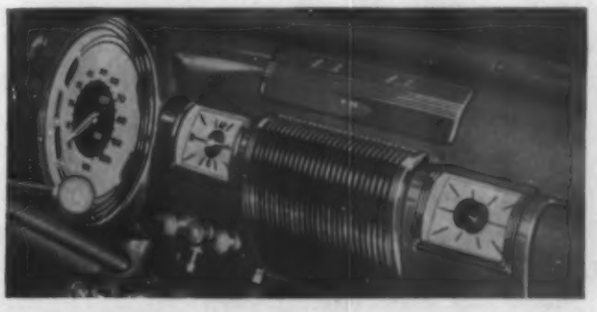
Molded Plaskon is lovely to look at . . . smooth and warm to the touch. It's light but extremely strong. Hard-surfaced, but will not chip, and can't corrode, rust or tarnish. Easily cleaned. Water, oils, organic solvents, or abrasion will not stain or mar its impenetrable, permanent finish.

These are but a few of the many distinctive qualities that have made Plaskon the world's largest selling urea-formaldehyde plastic—and one of the most versatile.

Buttons and buckles . . . bottle caps . . . cosmetic containers . . . handles, knobs and dials for motor cars, radios, electrical appliances . . . lighting reflectors . . . switch plates and other electrical wiring devices . . . housings and cabinets . . . these represent only a fraction of the wide variety of applications to which Plaskon has been adapted successfully and with profit.

Ask us for suggestions on how Molded Plaskon may be able to give *your* product new shelf appeal, eye appeal, *sales* appeal! A letter or wire will bring a Plaskon representative quickly.

Close-up photo of Lincoln-Zephyr V-12 instrument panel showing Plaskon-molded faces of ash receptacle, clock and dial assembly.



PLASKON COMPANY
Incorporated
2121 SYLVAN AVE. TOLEDO, OHIO
Canadian Agent: Canadian Industries, Ltd., Montreal, P. Q.

Trade Mark Registered

PLASKON

★ MOLDED COLOR ★

A Letter from London

THE year 1940 has been heralded in with a general rise in the price of molding powders and tools which has, of course, been passed on to the customer in the form of a 5–10 percent increase in price of all orders. Prior to the announcement of a general rise in the cost of molding jobs on January 1st, by several important molders, it was the custom during the first four months of war for firms to re-cost every order rather than quote a fixed percentage of increase on all orders. The present increase does not in any way represent finality and with tool costs steadily mounting there is little doubt that a 15 percent rise in the cost of moldings will be announced before six months have elapsed. This is not pessimism, but realism.

Luminous moldings for black-outs

Several very interesting developments can be recorded since my first general survey of the British plastics industry.* Probably one of the most important is the growth of business in luminous moldings of all kinds, from buttons to wear in the black-out to electrical accessories and indicators of various kinds. Manufacturers of luminous pigments have been innundated with requests for trial samples of pigments suitable for addition to both thermoplastic and thermosetting molding powders. Experience so far has been very mixed and it has been found that luminous pigments suitable in every way for the production of paints are not always capable of giving good results when mixed with urea-formaldehyde resins or cellulose acetate and polystyrol.

The difficulty has been, and indeed, still is, to insure even distribution of pigment throughout the finished molding. So far rejects from the injection molding process have been very high, some firms reporting as much as 25 percent. Re-use of the waste is possible, but subjection to too much heat leads to a diminution in the luminosity of the pigment. Incidentally the latter is very expensive, some brands costing as much as £3 per pound.

Plating plastics to save metal

For the last two years or so it has been the policy of the British Government to encourage the steady absorption of alien specialists into the home industry. The wisdom of this apparently disinterested policy is now being appreciated as some of Germany's finest technicians are now helping to produce goods which, before the war, were never made outside the Third Reich. In some cases new ideas have been brought to Great Britain by refugees from Austria and Czecho-Slovakia and developed with the aid of British capital. The plastics industry is today reaping the benefit of foreign initiative and British encouragement.

A process of metallizing plastics by a new method of electro-deposition which does not entail the use of graphite has now been perfected by a group of Czech technicians recently settled in a small factory near Cardiff on the Treforest Trading Estate. This method is of considerable potential value as it will enable great economies to be made in the use of metals, particularly copper and aluminum now closely controlled and mainly reserved for government work. For many applications in the industrial field a deposit of only one-half thousandth of an inch of metal on a specialized molding may serve the purpose of a solid casting, and besides conserving much needed metal, enable an appreciable saving in weight to be effected. Unlike previous attempts at metal deposition on plastics, and there are several about, the Menomat process envelops the surface with a film of metal that is literally impossible to remove except by continual abrasion. Unlike so many so-called electro-deposited metallized moldings the metal coating cannot be peeled off or removed in any way except by abrasion or wear.

No one who has seen examples of treated moldings can doubt that its exploitation on a wide scale will widen the scope of plastics to a very great extent. Apart from its obvious applications in the fancy goods trade it will undoubtedly prove of the utmost value to the electrical industry and may result in a considerable saving of metal and money. It is claimed that the process is unique and patents are pending.

John S. Trevor

* The British Plastics Industry in War Time, MODERN PLASTICS, Dec. 1939, page 25.

Stock Molds

SHEET NINETY-THREE

Handles, knobs and controls may be used for many practical purposes. Novelty items in bright colors are suitable for souvenirs or premiums. These items are available from stock molds without mold cost. Address Stock Mold Department, Modern Plastics, Chanin Building, New York for manufacturers' names and addresses

---

1112. Large red control handle, 4 3/4 in. overall length. Round end, 1 1/2 in. high; 1 5/8 in. diameter at top, with opening at base 11/16 in. by 3/8 in. Top opening 1/2 in. with 1/4 in. diameter through center. Four 1/8 in. openings on top. Flat end, with ridged sides, 2 3/4 in. long

1113. Large control handle same as 1112 but in black, and with two 1/8 in. openings on top

1114. Switch plate or junction block 2 7/8 in. by 2 1/8 in. by 5/16 in. high. Two 1/4–20 threaded brass binding studs and words "motor and line" molded in the plate

1115. Oval-shaped ball handle 1 9/16 in. high. Diameter 1 5/16 in. 7/16–20 threaded brass insert

1116. Clutch knob with "start" and "stop" instruction molded around top edge. Overall diameter 1 3/4 in. 5/16–18 brass thread at base

1117. Terminal knob with fluted edge. 3/4 in. in diameter. 5/16 in. threaded brass insert. 7/8 in. overall height

1118. Cigaret extinguisher in colors. 7/8 in. high with 7/16 in. opening. Trade names may be molded in

All molders are invited to submit samples from stock molds to appear on this page as space permits. Reprints of Sheets One to Fifty-two in book form, Twenty-five cents in coin or stamps

1119. Molded thimble in various colors. 3/4 in. diameter. 7/8 in. high

1120. Colored measuring cup, 1 in. at base with 1 1/4 in. opening. Horizontal ridges indicate levels

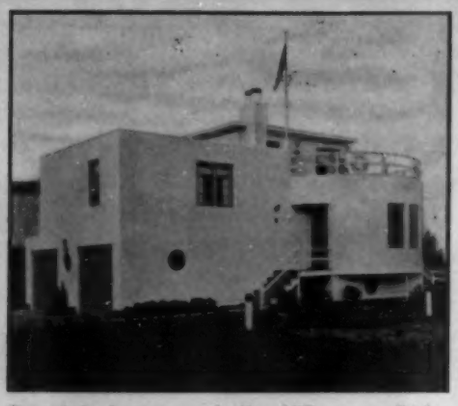
1121. Self-ejecting cigaret holder in colors. 2 1/8 in. long. Two molded sliding parts permit removal of cigaret stub

1122. Pocket powder dispenser with press-in top and base in contrasting colors. 2 1/4 in. long by 1/2 in. in diameter.

1123–4. Colored thimbles 5/8 in. in diameter; 3/4 in. high

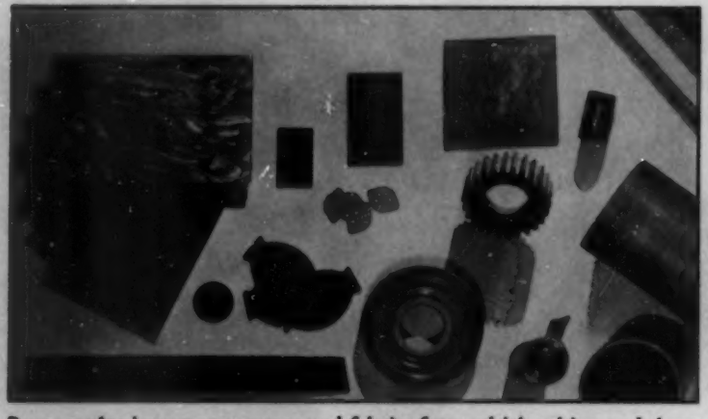
BONDING, IMPREGNATING, INSULATING AND LAMINATING RESINS

Special Durez resins have been developed for adhesives of many kinds. They produce a strong bond with high resistance to oil, soaps, mild acids, and alkalis.

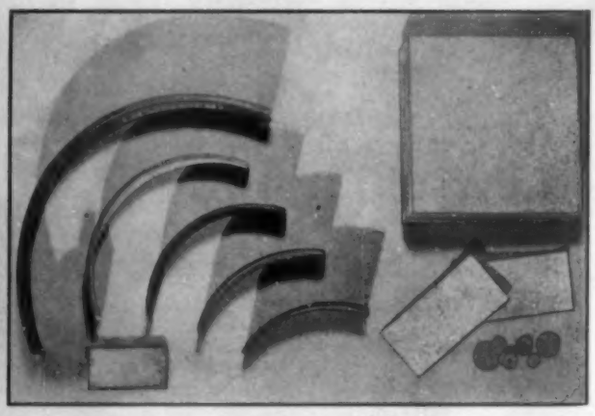


Complete homes are built of "Resnprest" plywood which is Durez bonded because the Durez glue-line is waterproof, and resistant to termites, fungus and mold growth.

Grinding wheels made with Durez resins as a bond can be operated safely at higher speeds, consequently cut faster. Toughness of these resins insures longer wear.



Durez resins impregnate paper and fabrics from which tubing and sheet laminated materials are pressed, serving as both a bond and surface finish. These materials are used for electrical insulation, refrigerator breaker strips, silent gears and many other purposes.



Brake linings impregnated or bonded with Durez resins show longer wear and more uniform coefficient of friction. Composition cork bonded with Durez stands boiling water.

Durez resins are among the most versatile materials in modern industry—with myriad applications.

With Durez resins brake linings hold better and wear longer . . . grinding wheels are bonded . . . cork is bonded for resistance to water and oil . . . armatures, wires, coils and many other electrical parts are insulated. They are used to bond plywood and make it resistant to moisture, vermin, fungus growth.

Durez resins are used in a variety of other applications where heat resistance, electrical insulation, strength of bond, solvent resistance, are vital to the success of the product. Possibly you have a need for some of these resins somewhere in your product or process. There are many types of Durez special resins, each designed for definite applications. Most of them require heat and pressure for application. Our engineering staff and laboratories are always ready to help you choose or develop the one which fits your requirements best. Just write Durez Plastics & Chemicals, Inc., 583 Walck Road, North Tonawanda, N. Y.

DUREZ PLASTICS & CHEMICALS, INC.

PLASTICS THAT FIT THE JOB

Technical Section

Service-Temperature Flow Characteristics of Thermoplastics*

by W. F. BARTOE**

IT IS customary to publish in a table of data of properties of an organic plastic some figures which are called tensile strength, compressive strength, flexural strength, elongation, hardness, modulus of elasticity, and the like. Seldom are these data of any value when considered individually. If one is acquainted with similar data as they apply to other plastics, or if he has available a larger table giving a comparison of these properties, an estimate can be made of the probable performance of the material in question, but at best this estimate will be only a first approximation. This is partly due to the wide differences in methods used by different laboratories in testing different materials. It is recognized that these differences in methods make for real differences in results.

Fortunately for those of us who prepare such data, and more fortunately for those who attempt to use it, considerable effort is being expended in an attempt to unify test methods. Unfortunately, it appears that this end, if and when it is attained, will probably fall short of eliminating all question in making a direct comparison of materials for a given application. It will fall even shorter of giving the engineer, who is designing a new structural application, all of the information necessary to assure the success of his design. It is hoped that future tables of properties will list all of the desired data. At present, it appears that a chart containing these data would have to be extensive and cumbersome. In the meantime the designer and engineer, urged by some definitely desirable property of a material such as specific gravity or transparency or some characteristic such as formability, are proceeding by "cut-and-try" methods. It is the purpose of this paper to point out some of the simpler aspects of two of these "properties" (the so-called tensile and compressive strength) in the hope of promoting thought and experimentation toward simplification of the future problems of structural applications of thermoplastic resins.

* Röhm & Haas Co.,

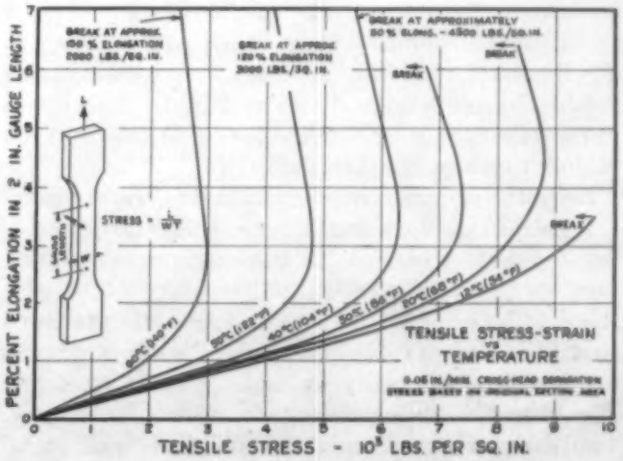
** Presented before the Rubber and Plastics subdivision of the Process Industries Division at the Annual Meeting, Philadelphia, Pa., Dec. 4-8, 1939, of The American Society of Mechanical Engineers.

Effect of External Stresses

Stress-bearing members of metal used at temperatures up to about 400 deg. F. do not seem to present much of a problem to those who work with them every day. This situation is somewhat changed when service temperatures above, let us say, 1000 deg. F. are involved. However, the problems of stress-bearing members of organic plastics used at ordinary room temperature can be likened to those of the use of metals at ten times this temperature. For example, Fig. 1 shows the tensile stress-strain relationships, at various temperatures, of a thermoplastic resin which is usually quoted in physical data tables as having a tensile strength of 7000 to 9000 psi. (The conditions of testing are specified on the curves.) This is obviously a misstatement, since the maximum tensile stress varies almost 4000 psi within the range of ordinary room-temperature changes. Since temperature changes of −20 deg. F. to 140 deg. F. are not uncommon in human experience, it may be concluded, therefore, that the original statement of tensile strength was hardly more than the expression of an order of magnitude.

A second important factor is indicated by the curves of Fig. 2, which shows the different tensile stress-strain

Fig. 1


BREAK AT APPROX. 150 % ELONGATION 7000 LBS./SQ. IN.
BREAK AT APPROX. 120 % ELONGATION 3000 LBS./SQ. IN.
BREAK AT APPROXIMATELY 50 % ELONG. - 4500 LBS./SQ. IN.
BREAK
BREAK
BREAK
STRESS = W/V
PERCENT ELONGATION IN 2 IN. GAUGE LENGTH
TENSILE STRESS - 10³ LBS. PER SQ. IN.
TENSILE STRESS-STRAIN vs TEMPERATURE
0.05 IN./MIN. CROSS-HEAD SEPARATION
STRESS BASED ON ORIGINAL SECTION AREA

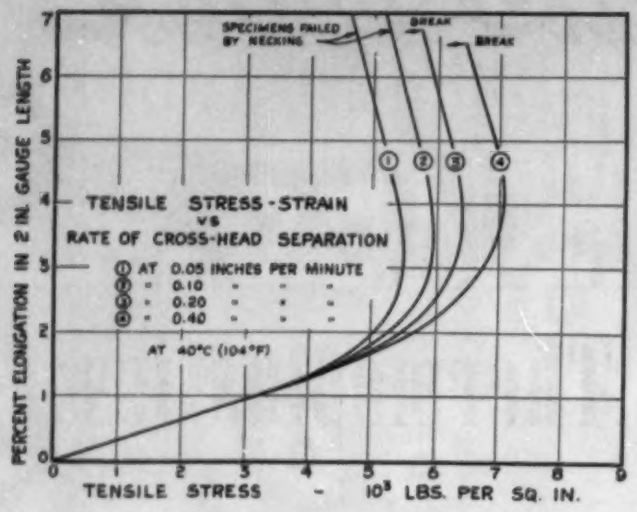

SPECIMENS FAILED BY NECKING
BREAK
BREAK
TENSILE STRESS-STRAIN
VS
RATE OF CROSS-HEAD SEPARATION
① AT 0.05 INCHES PER MINUTE
② " 0.10 " " "
③ " 0.20 " " "
④ " 0.40 " " "
AT 40°C (104°F)
PERCENT ELONGATION IN 2 IN. GAUGE LENGTH
TENSILE STRESS - 10³ LBS. PER SQ. IN.

Fig. 2

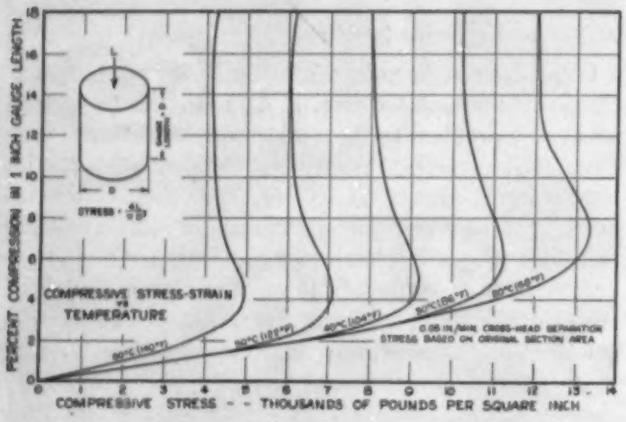

COMPRESSIVE STRESS-STRAIN
VS
TEMPERATURE
0.05 IN./MIN. CROSS-HEAD SEPARATION
STRESS BASED ON ORIGINAL SECTION AREA
PERCENT COMPRESSION IN 1 INCH GAUGE LENGTH
COMPRESSIVE STRESS - - THOUSANDS OF POUNDS PER SQUARE INCH

Fig. 3

curves obtained by using different time rates of testing. Because it is difficult to make such tensile-stress measurements, compressive-stress tests have been resorted to in extending this survey.

Compressive strength tests are usually made by squeezing a cube or cylinder of the material between the crossheads of a testing machine while measuring the load required and the relative displacement of the crossheads. The usual testing machine is designed to apply a constant rate of strain and by some balance mechanism to measure the resultant loads. Fig. 3 shows some compressive stress-strain data obtained in this manner for the same organic plastic whose tensile-stress-strain data were shown in Fig. 1. Again it is obvious that the usual "table value" of 11,000 to 13,000 psi fails to represent actual data.

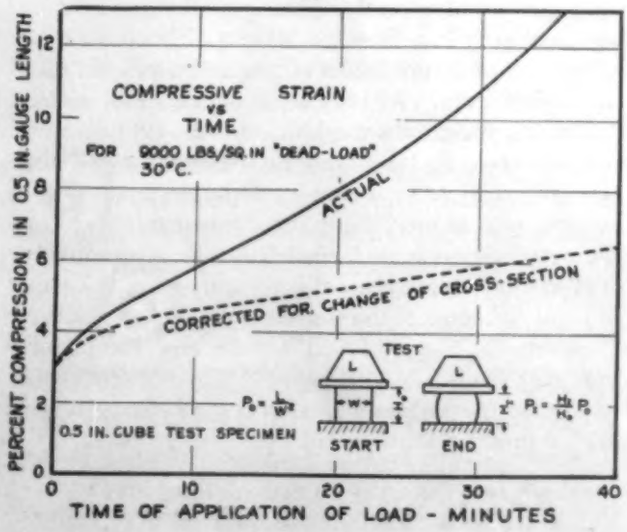
Since the compressive strength of an organic plastic is dependent on the temperature and the rate of straining (other factors such as test-specimen shape and previous history also enter into laboratory evaluation), it would be expected that none of the data presented would be of much value in designing for constant stress externally or internally applied. This is true, and Figs. 4 to 8, inclusive, show to what degree the structural designer must discount the published "table data."

Fig. 4 shows the relation between time of application of a constant load (applied between parallel plates by a lever-and-weight mechanism) and the compressive strain of a $^1/_2$-in. cube of the thermoplastic resin. The first deformation takes place so quickly that it cannot be shown on the curve except as a vertical shift from zero strain to a small (about 3 percent) flow-starting strain at zero time. From then on the rate of strain, as defined by the slope of the curves shown, tends to decrease with time. This decrease of rate of strain is partially due to a form of work hardening of the thermoplastic and partially to the decrease of the average unit compressive stress resulting from the "barreling-out" of the test specimen. The secondary upward turn of the curve is characteristic of some resins. It is probably due to some sort of breakdown of the structure of the resin. The effect of the change in cross sectional area has been approximately compensated in the dotted curve by calculating the instantaneous compressive stress at the end of the test and using this stress value to determine a corrected rate of deformation. The remaining curvature indicates the existence of a work-hardening effect in the resin.

The curve of Fig. 4 is for one initial value of compressive stress and one temperature. Other such curves can be drawn for other stress values and other temperatures. Such a family of curves soon becomes complex and difficult to visualize. For the purpose of practical use it is convenient to plot the logarithm of time versus the applied stress at some arbitrary temperature and plastic (gross minus first or elastic) strain value. Fig. 5 shows the details of such a curve for a 10 percent plastic strain and a temperature of 30 deg. C. (86 deg. F.). The usefulness of these data can be further extended by plotting a family of curves for different temperatures, such as are shown in Fig. 6.

If we now plot the compressive stress at 10 percent strain, obtained by compressing at the rate of 0.05 in. per min. (from Fig. 3), and the compressive stress which produces a 10 percent plastic (not completely self-

Fig. 4



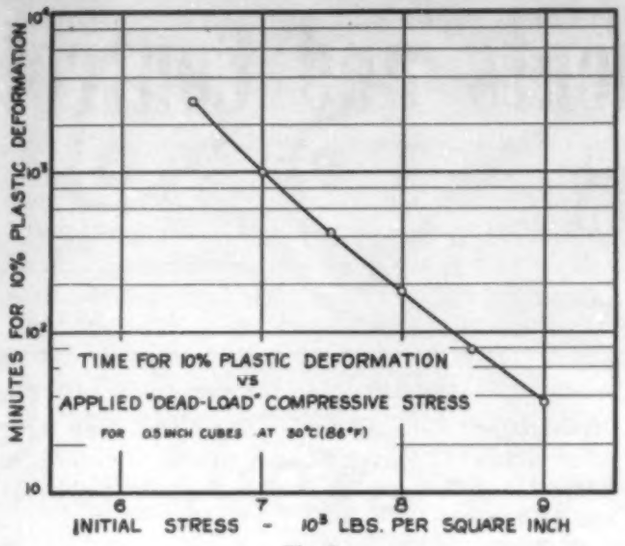

MINUTES FOR 10% PLASTIC DEFORMATION
TIME FOR 10% PLASTIC DEFORMATION
VS
APPLIED "DEAD-LOAD" COMPRESSIVE STRESS
FOR 0.5 INCH CUBES AT 30°C(86°F)
INITIAL STRESS - 10³ LBS. PER SQUARE INCH

Fig. 5

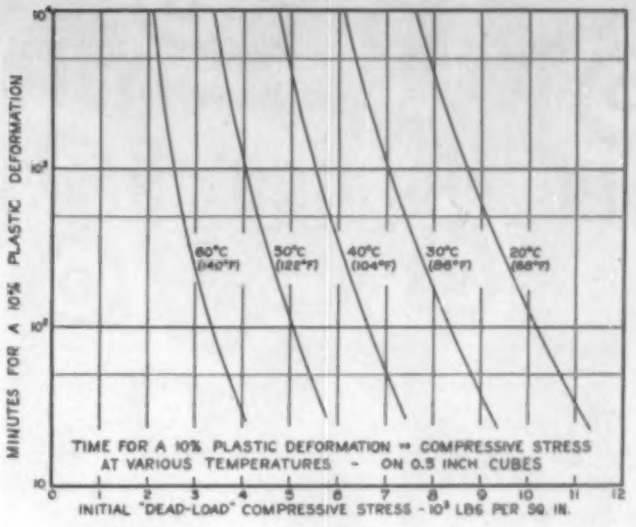

MINUTES FOR A 10% PLASTIC DEFORMATION
60°C (140°F)
50°C (122°F)
40°C (104°F)
30°C (86°F)
20°C (68°F)
TIME FOR A 10% PLASTIC DEFORMATION VS COMPRESSIVE STRESS
AT VARIOUS TEMPERATURES - ON 0.5 INCH CUBES
INITIAL "DEAD-LOAD" COMPRESSIVE STRESS - 10³ LBS PER SQ. IN.

Fig. 6

recoverable) deformation in 10,000 min. (about 7 days), versus temperature, we obtain the two curves shown in Fig. 7. The curve for sustained compressive stress lies below that for a sustained rate of compressive deformation at every temperature. From this it is obvious that the "table value" of 11,000 to 13,000 psi when used for designing a structural member, may be in error by a factor of as much as 7 within the temperature range.

All of these data have probably created the impression that such materials as these can hold little attraction for use in structural design. This might be true if it were not for the fact that some of the other properties of the material, such as the aforementioned low density, transparency, and formability, are desirable in some applications. In addition to this some of the synthetic resins are so homogeneous that when their limitations are known they are pleasing materials with which to work.

Fig. 8 shows an extended curve of compressive stress versus the logarithm of time for the acrylic resin that we have been considering. Such curves are tedious to obtain experimentally but are interesting because they encourage us by their upward turn at the lower stress values. This inflection indicates the existence of a limiting allowable stress which will not produce the specified flow. Other simulated service tests have shown that such a limit does exist. These observations have encouraged an ever-increasing number of uses of this resin as a stress-bearing material. Most of these applications have been in windows for pressure-tight enclosures where the qualities of formability, low unit weight, and optical clarity are desirable. Recognition of such stress-bearing limitations of plastic materials of construction should facilitate and improve these uses.

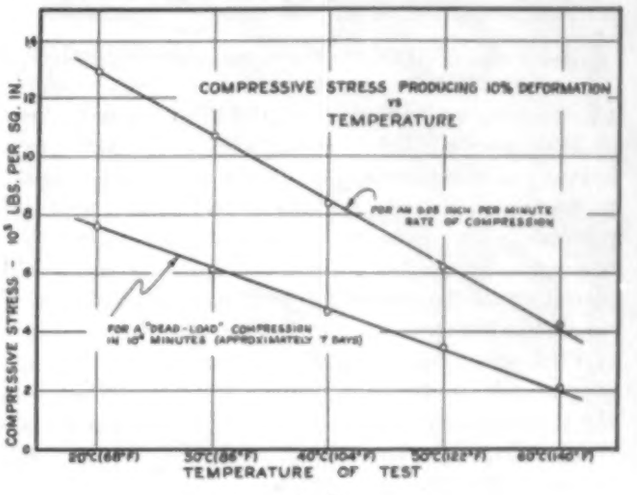


Fig. 7

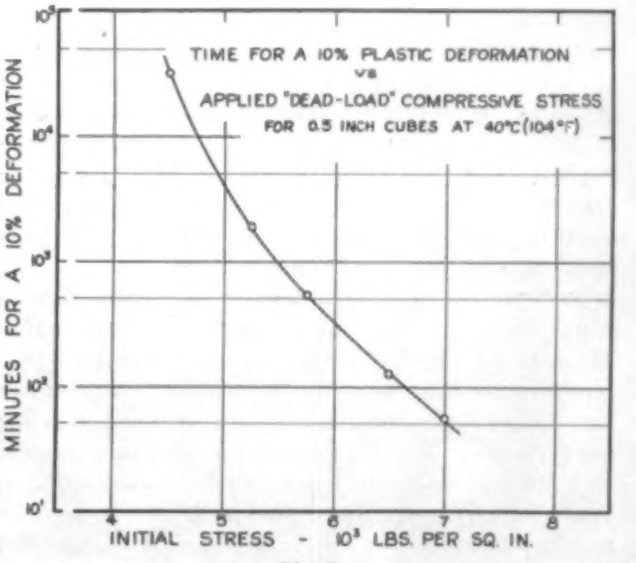

TIME FOR A 10% PLASTIC DEFORMATION
VS
APPLIED "DEAD-LOAD" COMPRESSIVE STRESS
FOR 0.5 INCH CUBES AT 40°C(104°F)
MINUTES FOR A 10% DEFORMATION
INITIAL STRESS - 10³ LBS. PER SQ. IN.

Fig. 8

Effect of Internal Stresses

Materials are also frequently subjected to the action of stresses which are not obviously existent. Molded thermoplastics are usually subjected to the action of internal stresses. Most of the thermoplastic resins now commonly in use have some elastic property. When these resins are molded (*Please turn to page 78*)

Thermal Measurements and Control in Molding Plastics

by J. DELMONTE*

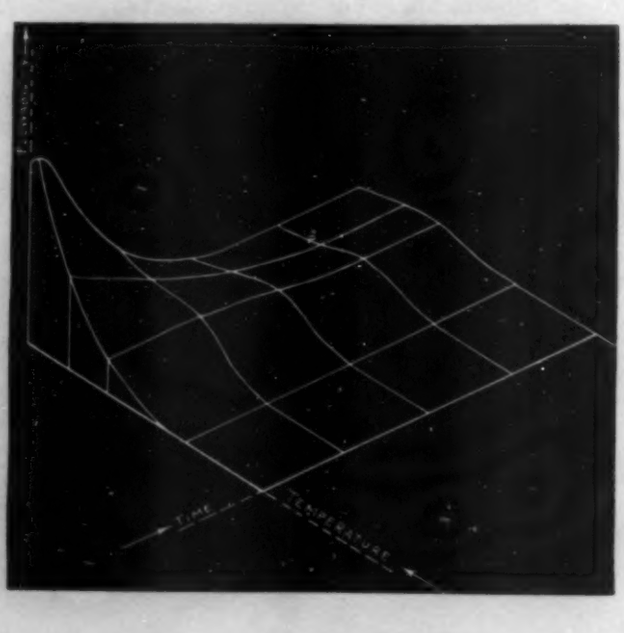
This paper was a contribution to the symposium on Temperature, its Measurement and Control in Science and Industry, held by the American Institute of Physics in November 1939. A complete report of this Symposium, including essentially all of the papers presented, will be published in book form by the Institute. (Editor's note.)

A LARGE proportion of organic plastic materials produced in this country today are made available as pressure molded articles fulfilling a wide variety of applications. While cold molding followed by a baking period is practiced by a few molders, the greatest proportion of organic plastics is molded under heat and pressure. The technique of molding these materials is a specialized art, in which much reliance has been placed upon the operator's experience, uniformity of quality in the molding material, and the dependability of heat and pressure sources. Recent trends in the plastic molding industry indicate a shifting of some of the responsibilities of the operators to automatic control features, in order to reduce rejects due to errors of human judgment. This has meant among other things, more elaborate temperature measurements and controls than have hitherto been employed. Examples of this trend have appeared in recent models of fully automatic injection and compression molding equipments.

In the preparation of organic plastic molding compositions, conflicting demands must often be satisfied in formulating the composition. For example, those materials that will give good flowing properties at the temperature of molding, may act adversely to the physical properties of the molded article at room temperature and vice versa. It has, therefore, been the general practice to develop a family of compositions in which various relationships between the molding qualities and the physical properties are maintained. Of fundamental importance to the molding industry are the temperature-flow relationships of these molding compositions. These relationships are very critical for some materials, which can only be molded within a very limited temperature range. Time is another significant factor—not only in how rapidly the material is brought up to molding temperature—but also in how long it is maintained at that temperature. Successful and economical molding is realized when for a given design and a given molding powder, the optimum temperature, flow and time relationships are established and maintained.

While all organic plastic molding compositions will flow under heat and pressure, some of them will cure to hard, infusible forms, while others will remain plastic indefinitely until the molding temperature decomposes or burns the composition. The thermosetting types, as typified by molded phenolic and urea plastics, possess flow characteristics as illustrated in Fig. 1. The behavior of materials at different molding temperatures is represented by an arbitrarily chosen flowability ordinate, which may represent flow characteristics such as the extent of flow under pressure. Thermosetting compounds rapidly lose their flow properties after exposure to high temperatures, and hence may be said to be more critical with respect to temperature than are thermoplastic materials. In contradistinction to the thermosetting resins are the thermoplastic materials, such as the cellulose plastics, methyl methacrylate, polyvinyl resins, and polystyrene, which will flow as long as heat and pressure are applied. Their characteristics are illustrated in Fig. 2, showing relatively little loss of flow properties with time. However, while these materials possess greater duration of flow at

Fig. 1. Thermal flow characteristics of thermosetting materials



* Chicago Flexible Shaft Co.

molding temperatures, the molds must be cooled below the heat distortion point of the material, so that the molded pieces will not be deformed when pushed from the cavities by the ejector pins. On the other hand, many of the thermosetting materials may be ejected when they are relatively hot, due to their higher heat distortion points.

While it is not proposed to go into great detail in examining the factors influencing the flow of organic plastics in this paper, the temperature-flow characteristics of the molding compositions may be better understood by examining the physical and chemical changes occurring in the material during molding. Of greatest theoretical interest is the behavior of thermosetting resins which are converted from relatively low molecular weight, soluble, fusible substances, to high molecular weight, infusible, insoluble materials in a process known as polymerization. The reaction of phenols with aldehydes is typical, for during molding under heat and pressure when the material is brought up to molding temperature, there is a brief period of high mobility following which the structure of the final molecule begins to assume its shape by the establishment of molecular linkages from one molecule to another through active methylene units provided by the aldehydes that are present. Once the formation of this complex molecular structure has commenced, the high mobility of the molding material rapidly falls off, growing less as polymerization proceeds. The time duration of this period of high mobility varies from one composition to another, depending upon the purpose for which it was formulated. For a given design the molder will select a composition that will have a sufficient time duration of flow to fill out the mold cavity completely, and at the same time, will not incur an excessively long curing time that would lengthen the molding cycle to an uneconomical period of time. The molder has some measure of control over the flow properties of this material by regulating the molding pressure and temperature.

The thermal considerations in molding thermoplastic materials are fundamentally different from those encountered for thermosetting compositions. Whereas the latter will set-up during molding and develop a high heat-distortion characteristic, thermoplastic materials will remain soft and moldable for an indefinite period at the molding temperature. These materials are fully polymerized before they are introduced into the molding compositions, when they are combined with plasticizers or other agents to control the flow qualities during molding, and the final physical properties. When the materials are molded by compression molding the mold must be cooled below the heat distortion point of the material before removing the molded article, leading to a high thermal inefficiency. On the other hand, a more favorable thermal condition exists in injection molding, where the hot, highly plastic thermoplastic material is forced into a cold die under high pressures. Under these circumstances the cooling period is a matter of only a few seconds, as the molding

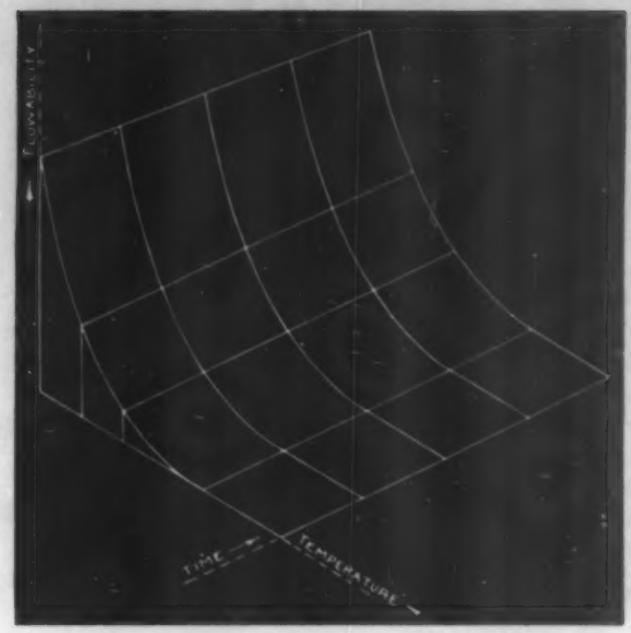


Fig. 2. General flow characteristics of thermoplastic materials

material rapidly gives up its heat to the large cool mass of metal in the mold. To fulfill the many engineering design requirements of molding, there are a wide selection of molding compositions, particularly among the cellulose plastics, which offer various degrees of flow for various molding temperatures. To obtain optimum benefits from a given material, the prescribed molding technique and temperature must be closely followed or preferably, automatically taken care of in the design of the molding machine.

Methods of molding

The two most widely used methods of molding organic plastics are compression and injection molding. While a particular material will require a certain pressure and temperature to mold a given design satisfactorily, the methods of obtaining this pressure and temperature differ widely in the injection and compression process. In compression molding, heat derived from platens or molds by methods that are outlined below, is transferred to the molding material which flows throughout the mold. An important phase of this molding cycle is the closing of the mold, which is usually done at reduced pressure. As the material begins to flow and heat is taken from the sides of the mold surfaces, full molding pressure is applied. When a thermosetting material is employed the material will take a set, and then for a certain period of time it is kept at that temperature while the optimum curing is obtained. For a thermoplastic material, no cure is required, once the material reaches the molding temperature and hence, it becomes necessary to cool the mold sufficiently until the temperature is low enough to permit safe ejection of the molded part.

From a thermal standpoint, injection molding is much better suited to thermoplastic materials. Molding material is forced under high unit pressure from a

plasticizing chamber through a nozzle into closed mold cavities which are at relatively low temperatures. The injection molding cycles and temperatures are adjusted so that the molding material does not lose its plastic flow in the gates or the molds due to chilling, and hence pressure is maintained on the material until the cavities are completely filled. For some articles, it may be necessary to operate the molds near the heat distortion point of the material to improve flow, though this procedure is more the exception than the rule. One of the biggest assets to injection molding is the inclusion of automatic features which permit an adjustment of temperature requirements to conform with the heat losses. The molding cycles for injection molding are very much shorter than for compression molding being of the order of several seconds to one minute for injection, and one-half minute to several minutes for compression molding.

Methods of heating

The most widely used methods of heating the molds in this country are steam heating and electrical heating. Steam heating is very popular for compression molding and far exceeds all other methods. The majority of molding plants carry steam boiler capacities up to 125 or 150 lbs. per sq. in., yielding respectively 352 deg. F. and 366 deg. F. It is better to provide an extra capacity of 10 or 15 deg. higher heat in the boiler than that actually required by the molding room. Live steam is circulated throughout the molding plant to the various presses, which are usually outfitted with reducing valves for lowering the standard pressure to that providing the proper molding temperature. Once this setting has been established, little changes should be required throughout the production run of a molded article. The steam pressure gage constitutes in fact a temperature measuring instrument, for the temperature is a direct function of the pressure in a constant volume system. Where the work is of a transient nature such that a wide discrepancy is liable between the temperature in the steam port and the surface of the mold, surface measuring pyrometers are available for checking various points about the mold surfaces.

Steam ports may be cored in the platens and the heat transferred by conduction to the molds, or a more efficient direct method is practiced for semi-automatic molding, where the molds themselves are cored for steam ports. The size and frequency of steam ports should be designed to maintain as uniform a temperature on the molding surfaces as possible, consistent with the high strength required to withstand the high pressures developed during molding. When it is possible, some form of thermal insulation should be introduced between the platens and the dead weight of the table and ram, to reduce heat losses to these parts.

Electrical heating is often applied to the injection molding machines by one of several methods, each of which employs some temperature responsive means to control automatically heat delivered to molding material:

(a) Electrical resistance wires are disposed in proper relationship with the plasticizing chamber and nozzle.

(b) Oil is heated electrically in a separate chamber and circulated about the plasticizing chamber, transferring its heat to the molding material.

(c) Heat is generated in the walls of the plasticizing chamber and spreader by hysteresis currents generated in the steel by a strong, low frequency, alternating current field.

(d) Electrical heat may be employed to develop steam in a small boiler for heating purposes.

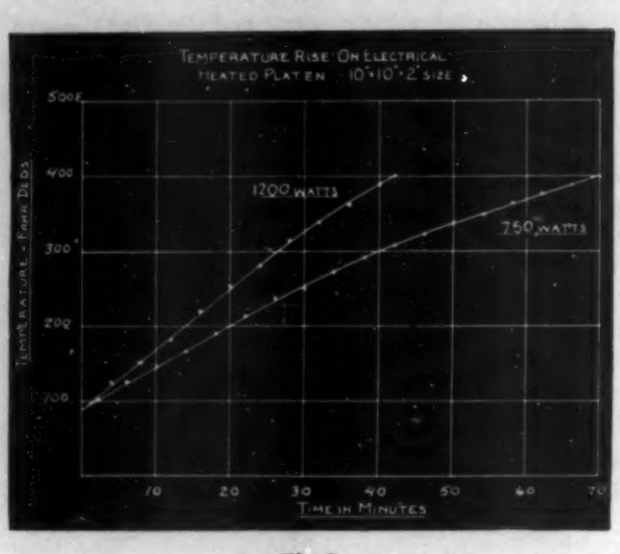


Fig. 3

The merits of the various methods are reviewed later in the paper when discussing the heat transfer problems arising in injection molding machines. It should also be pointed out that electrical heating of small platens for experimental testing is quite common, primarily because of the unavailability of adequate steam pressure in many laboratories for heating purposes. These are designed with temperature control instruments mounted upon a convenient panel. Temperature rise characteristics of a typical small, electrically heated platen are given in Fig. 3 for wattage inputs of 750 and 1200 watts. Approximately 350 to 400 watts are necessary to keep this platen floating at a temperature of 400 deg. F. when it is insulated from the table by asbestos board.

There are other methods of heating molds which may have some advantages under certain conditions. These include gas heating and hot, high pressure water heating, a few noteworthy installations of the latter having appeared quite promising in large molding establishments in this country. For a more thorough discussion of the methods of heating molds and their relative merits there are other publications.[1,2]

Compression molding

Heat transfer. From the standpoint of mathematical analysis of the heat transfer problems, the

[1] Plastic Molding by L. F. Rahm, McGraw-Hill Book Co., Chap. VI, 1933.
[2] Plastics in Engineering by J. Delmonte, Penton Publishing Co., Chap. X, available January 1940.

ramifications of compression molding and the many sizes and shapes in which molds appear are too multifold to attempt to formulate a general expression. Consequently, among the great majority of molders there is much cutting and trying until the optimum pressure and temperature are ascertained for a given design. However, there are fundamental factors which influence heat transfer in compression molding and which are studied in an effort to determine the best molding conditions. These considerations are tabulated and discussed below:

a. Difference between the temperature of the mold and the temperature of the material at the time it is introduced into the mold: It is a well known fact that preheating the molding material to reduce the temperature gradient with the mold surface, will permit material to flow sooner, reducing mold closing time.

b. Thermal properties of the molding material: Considerations such as specific heat and thermal conductivity of the material will affect the heat transfer rate. While there are not very great differences in specific heat among the more common molding compounds, there are many factors which influence their thermal conductivity such as the bulk factor of the material; whether it is preformed or not; and resistance to the compressive forces exerted by the molding pressure when the molds are closed. If the material is relatively soft it will be spread against the hot surfaces of the mold more readily and be brought up to molding temperature sooner than a harder material.

c. Ratio of surface area of molded article to volume: An important consideration after flow has commenced is the ratio of the total surface area to the volume, for there is a tendency for a more rapid setting time and shorter cure period the greater this ratio becomes. On the other hand, when very large areas are involved, particularly when they lie in a plane parallel to the line of molding pressure, the distribution and flow of molding materials to these surfaces are often serious problems. They are usually solved by employing a material with a long setting time, which may offset any time savings on the entire molding cycle.

Obviously when the heat transfer rate is so dependent upon the individual design features of the mold, some standards have to be established for comparing the flowing qualities of the various molding materials as affected by the molding temperature. This data is furnished by the materials manufacturers to the custom molders, who in turn study it in the light of the article to be molded. Peake's flow meter is one instrument commonly employed in studying the flow properties of molding compositions.[3] In one method of using this instrument, a tablet of the molding composition is placed under compression, though no flow is permitted, and after a period of time it is permitted to flow. This is repeated for various time intervals and at various molding temperatures, and a relation established between the extent of flow and the time. For thermosetting compositions, there is a decrease of the amount of flow with time, while thermoplastic materials suffer little change.

It is thus apparent in compression molding, where the heat for plasticizing the material during molding is obtained from the mold itself, that therein lies a condition suited to thermosetting materials, which must be heated as rapidly as possible to molding temperature. Further, these materials may be ejected from a hot mold without serious distortion, thus maintaining a good thermal efficiency of the molding cycle. On the other hand, thermoplastic materials in compression molding are rather costly as the molding cycle is prolonged by the time necessary to chill the mold and the decrease in thermal efficiency of molding.

Heat losses. Heat losses occur by conduction from the molds and platens to the dead weight of the molding machine contained in the table, ram, frame, etc., of the press. It is frequently necessary to make some correction or allowances in the heat supply for the upper half of the mold which tends to be hotter due to convection currents from the lower portion. Radiation losses to the atmosphere and to various parts of the press are quite high, and in fact only a small percentage of the total heat supply is applied to the molding material. The nature of the molding operations will have some bearing upon the heat losses. For example, when hand molds are employed and heat transferred from steam platens, the losses are quite high as the molds are carried from the steam platens to the unloading fixture. Permanent mounting of molds and the direct steam heating of semi-automatic molding have many advantages, as the heat losses will assume a constant rate and the time of the molding cycle and molding temperature may be regulated to those giving the best results. There is an increasing tendency toward close cycle control in compression molding where mold closing time, breathing, curing, and ejection are provided for automatically in the design of the machine, requiring an operator merely to remove the molded pieces and load the cavities with material. The success of these operations are dependent to a large measure upon the maintenance of the correct molding temperature.

Measurements. While very dependable temperatures are provided by constant-pressure saturated steam, the ramifications of molding surfaces make it impossible to expect uniform temperatures on these surfaces. Theoretically the temperature gradient between a molding surface and the steam ports depends upon the distance from the steam ports; heat capacity and thermal conductivity of the mold steel; location of the surface with respect to the rest of the mold cavity and radiation and convection losses. This temperature gradient may be as much as 20 or 25 deg. F., and for this reason molders feel that the only positive test of whether the correct molding temperature has been attained is to mold pieces under production conditions, when the heat losses have reached a steady

[3] Measuring the Plasticity of Hot Molding Compounds by G. L. Peakes, p. 39, *14*, Modern Plastics, June, 1937.

rate. If the articles are molded satisfactorily within a reasonable molding cycle, it is likely that mold surfaces are within the allowable molding temperature range.

However, molders keep on hand portable surface pyrometers for checking the temperature of molding surfaces. This is quite important for materials such as urea plastics which have a limited molding temperature range, and which lose their attractive appearance if molded in excess or below the prescribed temperature limits. Some of the compression molding temperature ranges recommended by manufacturers of the materials are as follows:

Material	*Recommended Compression Molding Temperature Range Deg. F.*
Urea-Alpha Cellulose Filler Standard Medium Grade	300–320°F.
Cellulose Acetate Grade MS	285–305°F.
Phenol-formaldehyde with wood flour filler	280–360°F.
Methyl Methacrylate Grade M	320–350°F.
Polystyrene	240–350°F.
Polyvinyl Chloride-Acetate	250–300°F.

In the forming or molding of large bearings or gears from laminated phenolics, fabric reinforced, some manufacturers have equipped their standard molds with recording thermometers to obtain a record of the temperature conditions. Temperatures are maintained on the mold surfaces in the neighborhood of 345 deg. F. for a period of about one-half hour. The recording instruments are particularly valuable when the molding cycle occupies a long period of time, as the operator may devote his time to several presses, making periodic checks of the time and the temperature on the recording chart. On the other hand, when very much shorter molding cycles are in progress and multiple cavity molds are employed, there may be some question as to the efficacy of a continuous temperature recording instrument, which may give a correct reading for one mold, but not necessarily the others. A useful guide to the average temperature throughout all the molds is the steam pressure gage at the steam inlet to the mold construction.

Preheating. Of increasing importance to thermosetting compounds is the practice of preheating molding materials before they are placed in the molds. In the past, this practice has been abused due to the absence of proper temperature control features, with the result that the benefits normally accruing from preheating are lost. For example, many operators have been in the practice of placing tablets or preforms of the molding material upon mold platens which were far in excess of the temperature required for preheating. It has been shown[4] that as preheating temperatures for phenolics exceed 200 to 210 deg. F., the time during which the molding materials are kept at those temperatures becomes very critical, because the material may lose some of its desirable flow properties due to an advanced stage of polymerization brought on by the heat. On the other hand, when the materials are maintained at temperatures below 200 deg. F. through the use of proper temperature control devices, in a properly designed preheating chamber with no *hot-spots*, the benefits of preheating are augmented. When preheating has been conducted in the correct manner, the mold closing time is reduced due to the fact that the material is brought up to molding temperature sooner; and the removal of moisture and volatile matter from the molding powder reduces the curing time and effects an improvement in physical properties. In some of the more recent designs of preheating units, metallic containers with measured amounts of molding powder required for one mold cavity, are tumbled about so that a more uniform heat distribution will be present about the mass of the material. Otherwise, if the container is stationary, there will be a temperature gradient from the powder nearest the walls which are at the preheating temperature to the center of the mass.

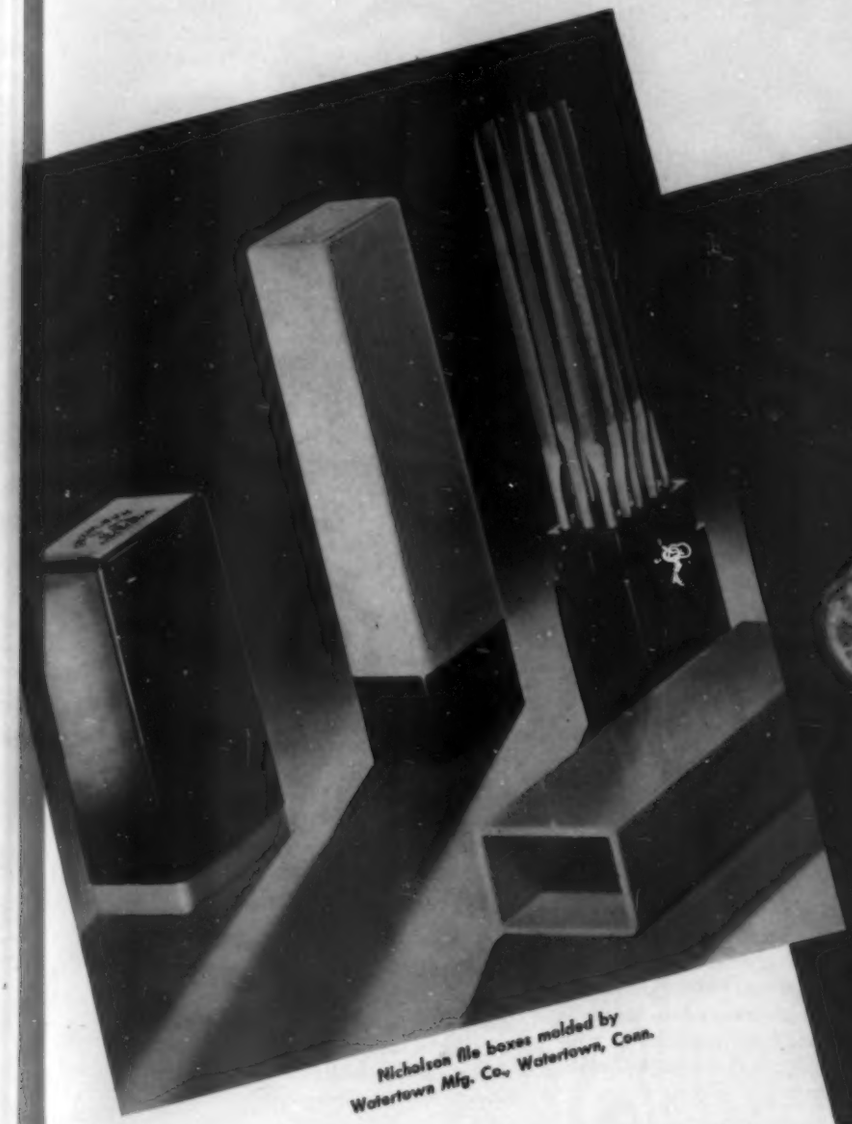
It may also be brought out in the discussion of preheating that similar methods are practiced for blanks of thermoplastic materials which are to be *swaged* to a given shape in a forming die. In such molding operations, the flow of material is very limited. Preheating is necessary only to raise the temperature of the thermoplastic material above its heat distortion point, allowing it to form readily when struck a sharp blow in the die. The chilling action of the cool mass of metal will cause the material to hold its shape. Electric steam preheating tables are usually employed for preheating the sheet stock of thermoplastic material. Electrical resistance coils are used to build up the steam pressure in a self-contained unit. Temperatures are controlled automatically to within 10 deg. F. by surface pyrometers, and extend over the range of 212 deg. F. to 320 deg. F.

Fully automatic compression molding. Much time and study has been given to the development of fully automatic compression molding of thermosetting materials. Automatic control of molding temperature is an important requirement of the cycle of operations. Employing electrically heated platens, sensitive temperature indicating controls are employed for each platen, keeping the temperature accurate to within a few degrees Fahrenheit. The thermal responsive elements are employed to operate relays in the molding press, which deliver full electrical power to the electrical heating cartridges. The significance of the correct molding temperatures to thermosetting compositions has already been pointed out. The molds in this type of press may also be equipped with steam rather than electrical heat, if the central source of heat is available over a 24-hour schedule, which is often carried out for automatic compression molding. (*Please turn to page 72*)

[4] Preheating Molding Materials by D. M. Buchanan, Vol. *13*, p. 45, Modern Plastics, January 1938.

Tenite wins top awards

IN ALL-AMERICA PACKAGE COMPETITION



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Closures for toothbrush containers molded by Owens Staple-Tied Brush Co., Toledo, Ohio.

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Plastics Digest

This digest includes each month the more important articles (wherever published) which are of interest to those who make plastic materials or use them. Requests for copies of the magazines mentioned should be directed to the individual publishers whose addresses will be mailed upon receipt of a self-addressed stamped envelope.

General

MECHANICS OF LIGHT FLUX CONTROL BY PLASTICS. M. H. Bigelow and A. F. Wakefield. Trans. Illum. Eng. Soc. *34*, 1189–98 (Dec. 1939). The optical properties of nine common inorganic materials frequently used for the fabrication of luminaires are compared with those of urea-formaldehyde and methyl methacrylate plastics. By appropriate pigmentation it is possible to change the rate of reflected and transmitted light, and hence surface brightness, without increasing the thickness of the plastic reflector.

THE RISE OF SYNTHETIC PLASTICS. E. F. Lougee. Dun's Review *47*, 22–8, 50–1 (Dec. 1939). A review.

THE NATURE OF ADHESION. N. A. De Bruyne. The Aircraft Engineer (Suppl. to Flight) *18*, 534a-d (Dec. 28, 1939). Strong joints cannot be made to polar adherends with nonpolar adhesives and vice versa. Wood which ordinarily is polar can be made to behave as a nonpolar material by heating. A method of detecting overheating of wood, leading to poor adhesion with polar glues, is based on angle of contact observed when a strip is dipped into toluene on water. Polar wood will pull the water meniscus up into the toluene zone; overheated wood will repel the water and give a negative angle of contact.

ACRYLIC RESIN PLASTICS. D. S. Frederick. Chem. Ind. *46*, 57–8 (Jan. 1940). A review of the development and applications of the acrylate plastics.

Materials and Manufacture

PREPARATION AND STRUCTURE OF HIGH MOLECULAR WEIGHT POLYBUTENES. R. M. Thomas, et al. J. Am. Chem. Soc. *62*, 276–80 (Feb. 1940). A discussion of the catalytic polymerization of isobutene at low temperatures to form a homologous series of polymers ranging to very high molecular weights.

COUMARONE RESINS. H. Barron. Chem. Age *41*, 397–9 (Dec. 16, 1939). The manufacture, properties, and uses of these resins in the coatings and rubber industries are surveyed.

POLYMERIZATION OF UNSATURATED HYDROCARBONS. H. M. Stanley. Chem. and Ind. *58*, 1080–3 (Dec. 16, 1939). The various types of hydrocarbon polymerization reactions and the mechanisms which have been suggested to explain them are reviewed. The thermal polymerization of styrene is considered in detail, including the influences of temperature and dilution. Discussion: Ibid. *58*, 399–401 (Apr. 29, 1939).

CASEIN PLASTICS. G. H. Brother. Ind. and Eng. Chem. *32*, 31–3 (Jan. 1940). Recent efforts toward technical improvements in the manufacture and formulation of casein plastics are discussed.

Applications

CELLULOSE ETHERS IN THE PRODUCTION OF HOT - MOLDED COMPOSITION TILES. L. Light. Brit. Plastics *11*, 350 (Jan. 1940). Formulas are cited for mastic floor tiles made from various materials, including gilsonite, coumarone resin, and ethylcellulose. One such composition is as follows: Cumar resin T5 12.5, ethylcellulose 6.5, asbestos 32, triphenyl phosphate 3, lead chromate 1, iron blue 0.5, and titanium blue 4 parts.

AIRPLANE DOPES. F. W. Reinhart and G. M. Kline. Ind. and Eng. Chem. *32*, 185–93 (Feb. 1940). The choice of a satisfactory plastic base for a relatively nonflammable airplane dope is limited to cellulose acetate propionate and cellulose acetate butyrate. The optimum hydroxyl content of the mixed ester for this use is about 0.2 equivalent. It is suggested that a cellulose acetate of about this same degree of hydrolysis would have better durability than the fully esterified cellulose triacetate. Solvent combinations and plasticizers which yield optimum tautness, resistance to slackening in wet weather, and least variation in tautness during exposure of the doped panels are reported.

RECENT ADVANCES IN TEXTILE FINISHING. L. Light. Chem. Age *42*, 49–50 (Jan. 27, 1940). Originally adopted for their anticreasing properties, synthetic resins and cellulose derivatives are now used in addition for fireproofing, dulling, stiffening, and rendering fabrics water-repellent.

TIMM 2-PLACE TRAINER. Aviation *39*, 53 (Jan. 1940). A description of an airplane molded in part from spruce veneers impregnated and bonded with phenol-formaldehyde resin.

Testing and Properties

STRUCTURE OF CELLULOSE AND OTHER POLYMERS RELATED TO SIMPLE SUGARS. W. N. Haworth. Chem. and Ind. *58*, 917–25 (Oct. 14, 1939). Lichenin from moss gives rise to cellobiose on hydrolysis just as does cellulose, but lichenin is soluble in water whereas cellulose is insoluble. Lichenin probably consists of singular molecular chains, while cellulose is made up of chains joined together at various positions along their length by cross linkages or valency bonds which structure has the effect of suppressing the solubilizing action of the hydroxyl groups. Experimental evidence for this hypothesis is presented.

WEATHERING AND TEMPERATURE STABILITY OF PAPER-BASE LAMINATES. W. Paul. Kunststoffe *29*, 326–9 (Dec. 1939). Urea-formaldehyde laminate is superior to the phenol- or cresol-formaldehyde type in weathering resistance, but inferior in resistance to elevated temperatures. Two hours exposure to 140 deg. F. causes a lowering in tensile strength of the aminoplastic laminate and it is unserviceable after 2 hours at 212 deg. F. The tensile strength of phenolic laminate increases after this material is exposed to 284 deg. F. for 24 hours. The phenolic material also shows as much as 30 percent increase in tensile strength at −292 deg. F., whereas the aminoplastic shows a slight decrease.

SORPTION OF WATER BY ORGANIC INSULATING MATERIALS. R. L. Taylor. Bell Lab. Record *17*, 370–2 (Aug. 1939). Laboratory studies of sorption effects help to predict the behavior of insulating materials in service, particularly with respect to resistivity, dielectric constant, and power factor. Information of this character is of practical importance in the telephone plant because of the increasing use of buried wire and the installation of circuits in locations exposed to high humidity.

MICROSCOPY IN THE RESIN INDUSTRY. T. G. Rochow. Ind. Eng. Chem. Analytical Ed. *11*, 629–34 (Nov. 15, 1939). An illustrated discussion of the use of microscopic methods in identifying plastics and studying the internal structure of molded products.

Coatings

DEVELOPMENTS IN LACQUERS AND ENAMELS FOR INDUSTRIAL FINISHING DURING 1939. G. Klinkenstein. Metal Ind. *38*, 61 (Jan. 1940). Fast-drying synthetic enamels are available which will bake hard in 5 minutes at 350 deg. F. Lacquer applied at 150 deg. to 160 deg. F. gives greater film thickness and faster drying time than ordinary sprayed lacquer. Infrared baking is proving satisfactory for finishing products with lacquers and quick-drying enamels.

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U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

SAFETY GLASS. J. H. Sherts (to Pittsburgh Plate Glass Co.). U. S. 2,184,876, Dec. 26. Facing glass, for safety glass, with a tough soft layer of polyvinyl butyraldehyde acetal resin, plasticized with glycol dihexoate, and a hard outer layer of unplasticized polyvinyl formaldehyde acetal resin.

SANDPAPER. N. E. Oglesby (to Behr-Manning Corp.). U. S. 2,184,896, Dec. 26. Applying abrasive particles to a paper or fabric backing with an unplasticized synthetic resin in which the particles are only partially embedded.

RUG. F. M. Allen (to Congoleum-Nairn, Inc.). U. S. 2,184,970–1, Dec. 26. A linoleum-type rug in which the binder for the wear-resisting surface layer is made from a drying oil, a cellulose ester or a synthetic resin.

VARNISH RESIN. A. Haroldson (to Continental-Diamond Fibre Co.). U. S. 2,185,080, Dec. 26. An oil-soluble resin is obtained by modifying a phenol-formaldehyde resin with a tung oil-maleic anhydride reaction product.

ZEIN COATINGS. R. E. Coleman (to Zein Corp. of America). U. S. 2,185,110–1–2–3–4–5–6–7–8–9–20–1–2–3–4–5–6, Dec. 26. Stable zein solutions, suitable for use as coating compositions, are prepared in organic solvents such as methanol, ethanol, glycol ethers, propyl or butyl alcohols, diethylene glycol, diacetone alcohol and others; modifying zein with an alkyd resin; and making protective varnishes from zein solutions, e. g., for coating paper.

UREA RESIN. T. S. Hodgins and A. G. Hovey (to Reichhold Chemicals, Inc.). U. S. 2,185,167, Dec. 26. Making a colorless water-soluble thermosetting resin from urea and formaldehyde in presence of ethylene glycol.

DUSTING POWDER. R. Beutner (to Parke, Davis & Co.). U. S. 2,185,178, Jan. 2. A phenol-formaldehyde resin, freed from uncombined phenol and formaldehyde to avoid irritant properties and capable of being heated without hardening, is used as a dusting powder to relieve pain and stop bleeding of wounds.

MOLDING COMPOSITION. S. Pellerano (to Garfield Mfg. Co.). U. S. 2,185,354, Jan. 2. Blending a coumarone-indene resin and an alkyd resin with oil, pitch and a filler.

COATED PAPER. H. F. Robertson (to Union Carbide and Carbon Corp.). U. S. 2,185,356, Jan. 2. Coating fibrous webs with a thin film or foil of vinyl chloride:vinyl acetate resin.

CLEAT. G. C. Birchfield. U. S. 2,185,397, Jan. 2. A detachable molded cleat for athletic shoes.

LAMINATED SHEETS. W. R. Thompson and Wm. E. Flood (to Catalin Corp. of America). U. S. 2,185,477, Jan. 2. Making flexible laminated sheet material by impregnating fabric with an alcohol solution of a hardenable phenol-formaldehyde.

MOLDING MACHINE. Earl R. Odom (one half to John B. Sisson). U. S. 2,185,678, Jan. 2. Improved feed mechanism in machines for molding plastics.

SYNTHETIC FIBER. H. Jacque (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,185,789, Jan. 2. Forming a film of organic thermoplastic high polymer material, stretching it to orient the molecules, and disintegrating the film into fibers by friction.

LIGHT APPLICATOR. Edwin A. Neugass. U. S. 2,186,143, Jan. 9. A curved illuminator for conducting light is made of an organic plastic.

MOLD. D. M. Anderson (to Standard Products Co.). U. S. 2,186,160, Jan. 9. Improved ejector device in a machine for molding thermoplastics.

BALLOON FABRIC. H. L. Trumbull (to B. F. Goodrich Co.). U. S. 2,186,183, Jan. 9. The wall of a gastight container is at least partly composed of plasticized polyvinyl chloride.

MOISTUREPROOFING. J. A. Mitchell (to E. I. du Pont de Nemours and Co.). U. S. 2,186,262, Jan. 9. A composition of nitrocellulose, wax and an arylsulfonamide plasticizer, for moistureproofing foils.

POLYSTYRENES. E. C. Britton, H. B. Marshall and W. J. Le Fevre (to Dow Chemical Co.). U. S. 2,186,359–60, Jan. 9. Interpolymerizing styrene with an unsaturated ester or ether of dioxanediol or an unsaturated phosphate ester.

HALIDE RESIN. G. H. Coleman, G. V. Moore and G. B. Stratton (to Dow Chemical Co.). U. S. 2,186,366, Jan. 9. Making benzene-insoluble elastic or nonelastic resins by condensing 1 mol of an aryl halide with 1 to 5 mols of an ethylene halide.

ADHESIVE. T. W. Dike (to I. F. Laucks, Inc.). U. S. 2,186,369, Jan. 9. An alkali solution of a water-insoluble, alkali-soluble phenolic resin which forms a deep, firm bond with wood.

RESIN. H. M. Dent and A. F. Shepard (to General Plastics, Inc.). U. S. 2,186,406, Jan. 9. Condensing gum accroides with a polymethylolphenol.

MIRROR FINISH. E. Freund and F. Deutsch (to E. I. du Pont de Nemours and Co.). U. S. 2,186,452, Jan. 9. A cellulose ester or ether solution containing a salt of copper, gold, silver or platinum is applied to a surface and the salt is reduced to give the surface a mirror finish.

LACQUER. W. E. Gloor (to Hercules Powder Co.). U. S. 2,186,454, Jan. 9. Pigmented lacquer containing cellulose acetobutyrate and acetopropionate, an alkyd resin and a plasticized vinyl resin.

VINYL ACETAL RESIN. G. B. Bachman (to Eastman Kodak Co.). U. S. 2,186,598, Jan. 9. Making stable polyvinyl acetal resins by reaction of a vinyl ester with aminobenzaldehyde or a dihydroxybenzaldehyde.

PLASTICIZERS. J. B. Dickey and J. B. Normington (to Eastman Kodak Co.). U. S. 2,186,631–2, Jan. 9. Plasticizing cellulose esters or ethers with tetrahydrofurfuryl tetrahydrofuroate or with a tetrahydrofuroate of a glycol or glycol ether.

(Please turn to next page)

Because Plastic Molding is the youngest of the major industries, men cannot, as yet, boast of a lifetime of service in this field. But pictured above are men (and there are many more in our organization) whose experience in this swiftly moving Plastic Molding industry has supplied them with a fund of knowledge which in most any other industry would take a lifetime to acquire. Through their hands in the past twelve to fifteen years have passed thousands of precision molds and millions of plastic molded parts—each one a lesson and a teacher to them in this art. Chicago Molded Products is justly proud of its employees. Proud of their abilities, their skill, their knowledge and their cooperative spirit. Proud of the important part they have played in the Company's success. Proud, with deep appreciation, to rate them the soundest asset a company can possess—a loyal force of willing, experienced workers. Their knowledge and experience is available to you on your plastic molding problems.

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LIQUID RESIN. W. R. Thompson and Wm. E. Flood (to Catalin Corp. of America). U. S. 2,186,687, Jan. 9. A liquid heat-hardenable phenol-formaldehyde resin, made by alkaline condensation and then acidified, dehydrated and thinned with alcohol.

SULPHIDE RESIN. M. A. Youker (to E. I. du Pont de Nemours and Co.). U. S. 2,186,714, Jan. 9. Resins made by condensing an alkylene dichloride or a dichloro ether with an inorganic sulphide are plasticized with a thiophenol and a thiuram disulphide, diaryl disulphide or arylenethiazyl disulphide.

MOLDING COMPOSITION. D. E. Cordier (to Plaskon Co.). U. S. 2,186,821, Jan. 9. Adding o-benzoyl-N,N-dibenzylhydroxylamine as a latent accelerator to thermosetting urea-formaldehyde resins.

MOLDING CASEIN. John A. Parsons. U. S. 2,186,881, Jan. 9. In molding casein plastics a thin strong sheet of metal is interposed between the molding composition and the mold face.

UREA RESIN. T. S. Hodgins and A. G. Hovey (to Reichhold Chemicals, Inc.). U. S. 2,187,081, Jan. 16. Condensing dimethylolurea with an acetal to form a resin.

MOLDING. Hugh C. Lord. U. S. 2,187,165, Jan. 16. In molds for plastics an improved method and apparatus for curing the molding composition.

RUBBER PLASTIC. J. Söll (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,187,185, Jan. 16. Converting rubber to a plastic by the action of concentrated hydrofluoric acid.

LACQUER RESIN. H. A. Gardner and A. Kirkpatrick (to Monsanto Chemical Co.). U. S. 2,187,199, Jan. 16. A resin composition which is compatible with cellulose esters contains an alkyd resin, a sulfonamide resin and a phthalate ester plasticizer.

LAMINATED SHEETS. O. R. Ludwig (to Röhm and Haas Co.). U. S. 2,187,383, Jan. 16. Impregnating a fibrous sheet material with a blend of urea resin and a polyacrylate emulsion, drying the sheets and laminating them under heat and pressure.

RESIN. H. A. Bruson and John W. Eastes (to Resinous Products and Chemical Co.). U. S. 2,187,565, Jan. 16. Forming a resin by heating an aromatic keto acid having a hydroxyl, acyl or ether group as a substituent.

RESIN PLASTICIZER. H. A. Bruson (to Resinous Products and Chemical Co.). U. S. 2,187,566, Jan. 16. Nitrogenous resins which contain methylol groups are plasticized with condensation products of a nitropolyhydric alcohol and a resin-forming polycarboxylic acid.

ACETAL RESIN. G. Kränzlein and U. Lampert (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,187,570, Jan. 16. An amorphous alkali-soluble resin comprising polyvinyl acetals of carbonyl compounds containing free carboxyl groups.

POLYSTYRENE. S. M. Stoesser (to Dow Chemical Co.). U. S. 2,187,695, Jan. 16. Plasticizing polystyrene resins with an equal quantity, or less, of a chlorinated diphenyl ether.

INTERPOLYMERS. H. Hopff, G. Steinbrunn and H. Freudenberger (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,187,817, Jan. 23. Interpolymerizing vinyl chloride with an alkyl maleate.

COLLARS. W. M. Billing (to Hercules Powder Co.). U. S. 2,187,848, Jan. 23. Use of chlorinated rubber, rubber hydrochloride or chlorinated rubber hydrochloride as a thermoplastic nonbleeding binder in permanently stiffened collars, cuffs and the like.

DRYING RESINS. F. R. Ferris and E. T. Carte (to Carbide and Carbon Chemicals Corp.). U. S. 2,187,877, Jan. 23. A continuous process for spray-drying a heat-sensitive thermoplastic resin.

SHAPED ARTICLE. A. Voss and H. Stärk (to I. G. Farbenindustrie Aktiengeselischaft). U. S. 2,188,272, Jan. 23. Molding a resin formed by hydrolyzing the vinyl ester group of an interpolymer formed from a vinyl ester and a maleic acid derivative.

GOLF BALL COVER. J. A. Merrill (to Wingfoot Corp.). U. S. 2,188,284–5, Jan. 23. Condensing rubber or balata with a chloroprene polymer to form a tough, thermoplastic material for golf ball covers.

ARC RESISTANT SHEET. Ellsworth F. Seaman. U. S. 2,188,317, Jan. 30. A noncarbonizing arc resistant laminated sheet material is faced on both sides with mica, bonded by a synthetic resin cement to a laminated phenolic resin sheet.

COATED FABRIC. W. H. Carothers (to E. I. du Pont de Nemours and Co.). U. S. 2,188,332, Jan. 30. Coating fabrics with a fiber-forming synthetic linear condensation polymer.

ACETAL RESIN. C. R. Fordyce (to Eastman Kodak Co.). U. S. 2,188,344, Jan. 30. Deacetylating a polyvinyl acetal-acetate resin to form a polyvinyl acetal resin.

SAFETY GLASS. J. D. Ryan and G. B. Watkins (to Libbey-Owens-Ford Glass Co.). U. S. 2,188,395, Jan. 30. A partially hydrolyzed cellulose mixed ester as interlayer in safety glass, with the same ester (more completely hydrolyzed) as the bonding agent.

VINYL CHLORIDE PRODUCTS. W. L. Semon (to B. F. Goodrich Co.). U. S. 2,188,396, Jan. 30. Molding polyvinyl chloride by making it into a paste with a liquid which dissolves the resin in the hot but not in the cold, heating the mixture in a mold, and cooling to gel the resulting solution.

PROTEIN PLASTICS. Chas. M. Albion. U. S. 2,188,468, Jan. 30. Preserving perishable protein plastics by plasticizing with a hydrogenated phenol and adding to the system a resin solvent (Tetralin or Decalin) and a wetting agent.

SPIRAL BINDER. F. F. Farkas (one-half to E. N. Farkas). U. S. 2,188,680, Jan. 30. A spiral coil for spiral bound looseleaf books is made of a plastic.

VINYL ETHER RESINS. W. Reppe and E. Kuehn (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,188,778, Jan. 30. Vinyl ethers containing a basic group in the molecule are polymerized in presence of sulphur dioxide.

CIRCUIT INTERRUPTER. H. Burmeister (to General Electric Co.). U. S. 2,188,806, Jan. 30. A circuit interrupter contains a loose cellulose or cellulose hydrate substance and a hardened urea resin, both being adapted to evolve an arc-extinguishing gas at high temperatures.

VARNISH RESINS. Edwin T. Clocker. U. S. 2,188,882–3–4–5–6–7–8–9–90, Jan. 30. Making varnish resins by condensing maleic acid or its derivatives with long chain aliphatic unsaturated acids or their salts or esters; coating alkaline-reacting substances with such condensation products; reacting such a condensation product with a substance which combines with the acidic group of the long chain acid; or forming a water-insoluble salt; or combining the condensation product with an oil or wax to form a water-dispersible system; using an unsaturated non-drying oil as one component in the condensation reaction; coloring the condensation products by combining at the acid group with a basic dye; and forming phenolic resins by condensing a phenol with a condensation product of the specified type.

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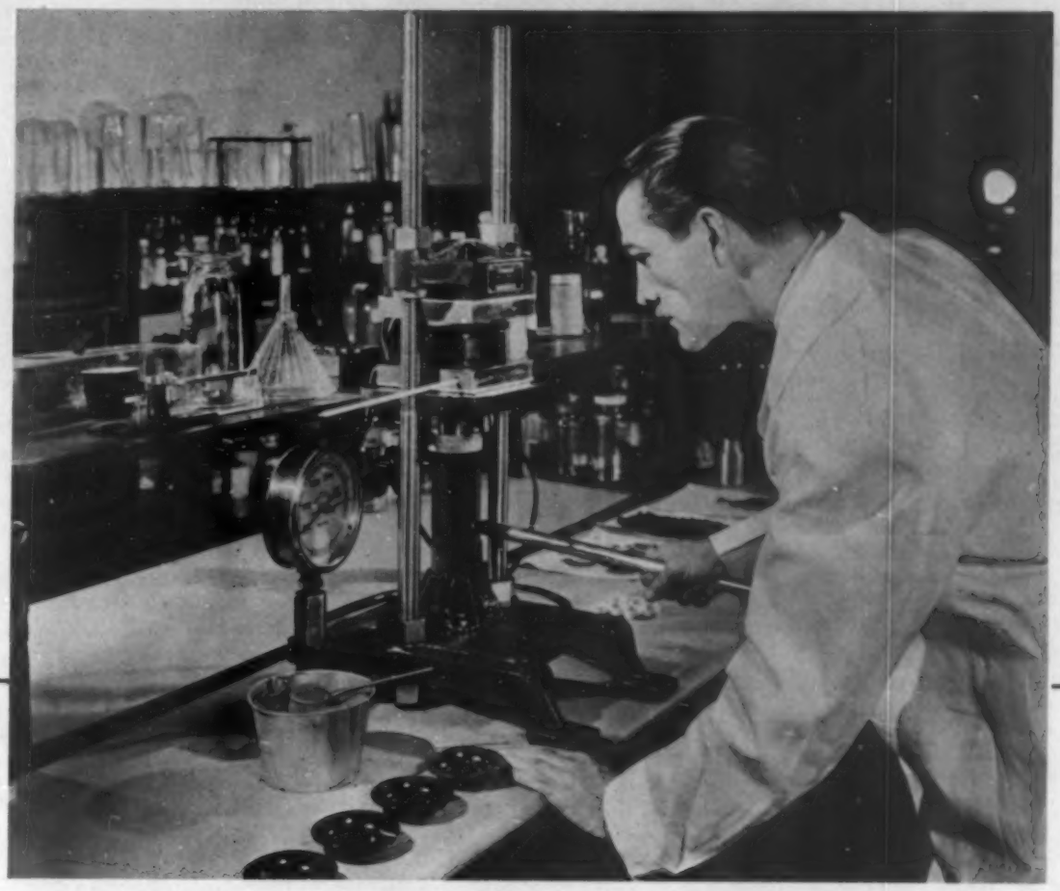

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Foreign Plastics Patents

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ELECTRIC INSULATION. A. Liechti (to Micafil A.-G. Werke für Elektro-Isolation und Wicklerei-Einrichtungen). Swiss Patent 201,412, Jan. 12, 1938. Dielectric layers for condensers, and guide tubes for electric connections, are made of hardened (resin impregnated) paper in which all pores and cracks are sealed by treating with styrene, then polymerizing the styrene.

INSULATED CONDUCTORS. I. G. Farbenindustrie A.-G. British Patent 502,046, Sept. 16, 1937. Oil-permeable microporous foils of cellulose triacetate are impregnated with oil for use as insulation on wire. The foils may be made from a blended solution of cellulose triacetate and polyvinyl chloride.

COATED FOILS. Gerhard E. Koken. German Patent 676,179, Aug. 31, 1933. Metal foil is coated with a urea-formaldehyde resin and nitrocellulose blend, and the coating is hardened by heat.

BUTTONS. S. Sborowitz and J. Laupheimer. German-Austrian Patent 155,809, Jan. 18, 1937. Making buttons, insignia and other shaped articles from hardenable synthetic resin molding compositions by lining a mold with cellulose acetate foil, then with decorated paper, filling with the molding powder and molding under heat and pressure.

AIR-INSULATED CABLE. Siemens und Halske A.-G. French Patent 837,725, May 9, 1938. Insulation for high frequency cables is applied by winding the conductor spirally with polystyrene tape, then with additional layers of polystyrene or polyvinyl chloride tape, the layers being held apart by a winding of thread.

ABRASIVES. Deutsche Norton-Gesellschaft m. b. H. German Patent 675,149, May 21, 1935. Use of a phenolic resin binder in abrasive disks in which a small proportion of cryolite is added to the abrasive particles to increase grinding efficiency.

ABRASIVE. J. N. Kuzmick and L. S. Hilton (to Raybestos Manhattan, Inc.). Canadian Patent 384,725, Oct. 17, 1939. A bond for abrasive particles comprises chloroprene compounded with 10 to 50 percent of a cresol-formaldehyde resin (modified with tung oil); the resin lessens the elongation or stretch of the chloroprene.

STRUCTURAL UNIT. H. N. Atwood (to S. N. Acker). Canadian Patent 384,742, Oct. 17, 1939. Coating strips of wood with cellulose acetate, so that the wood is entirely surrounded by cellulose acetate, weaving the strips into a lock-weave mat, facing the mat on both sides with cellulose acetate sheeting and compacting the assembly under heat and pressure.

DIKETENE RESIN. A. B. Boese, Jr. (to Carbide and Carbon Chemicals Ltd.). Canadian Patent 384,869, Oct. 31, 1939. Condensing diketene with paraformaldehyde to form a resin.

CLARIFYING RESINS. M. C. Reed (to Carbide and Carbon Chemicals Ltd.). Canadian Patent 384,870, Oct. 31, 1939. Vinyl resins are clarified by dissolving the resin in an organic solvent, acidifying with phosphoric acid or an organic acid in barely sufficient quantity to flocculate colloidal impurities, and filtering the solution to obtain a clear resin.

SYNTHETIC SIZE. Societé pour l'Industrie Chimique á Bâle. Swiss Patent 203,436, June 1, 1939. A hardenable urea-formaldehyde resin for textiles is rendered more water-repellent by adding starch or a wax.

PLASTICS. G. S. Petrov, A. G. Golubkova and V. K. Kozlova. Russian Patent 51,584, Aug. 31, 1937. A plastic is prepared by saturating an organic filler with an alkaline solution of a urea-aldehyde resin, ammonium benzoate or phthalate and excess ammonia.

WOUND DRESSINGS. R. Beutner. British Patent 505,972, Oct. 16, 1937. A film-forming preparation for application to the skin is made by mixing an alcohol-soluble phenol-formaldehyde resin with a medicinal agent or disinfectant for the skin, e. g., iodine, camphor, mercurochrome or the like, in alcohol solution.

PRESERVING SPECIMENS. I. G. Farbenindustrie A.-G. British Patent 507,175, Dec. 10, 1937. Urea-formaldehyde resins, prepared in presence of glycerol or a glycerol ester or ether, or sugar, are used to embed plant or animal specimens so that they will be visible, yet protected.

TREATING RESINS. Wm. O. Kenyon and T. F. Murray, Jr. (to Canadian Kodak Co., Ltd.). Canadian Patent 384,966, Nov. 7, 1939. Vinyl acetal resins which are unstable by reason of containing ester or free hydroxyl groups are stabilized by hydrolysis or alcoholysis to remove these groups.

GRENADE. Aldo S. Bevacqua. Canadian Patent 385,040, Nov. 14, 1939. A casing for bombs or hand grenades is made of fabric impregnated with a synthetic resin, which is then polymerized.

INJECTION MOLDING PLASTIC. G. H. Wilder (to E. I. du Pont de Nemours and Co.). Canadian Patent 385,063, Nov. 14, 1939. A plastic, suitable for injection molding, comprises an olefinsulphone resin which has been freed from excess sulphur dioxide.

POLYSTYRENE. A. J. Warner and A. A. New (to International Standard Electric Corp.). Canadian Patent 385,103, Nov. 14, 1939. Plasticizing polystyrene with up to 20 percent of phenanthrene or isoamylnaphthalene.

MOLDING COMPOSITIONS. Bakelite-Gesellschaft m. b. H. French Patent 837,828, May 11, 1938. Fibrous fillers such as wood flour, shredded fabric or asbestos are first treated with a small amount of a resin, starch or glue, then compounded with a synthetic resin.

SYNTHETIC RESIN FOILS. Röhm und Haas Aktiengesellschaft. French Patent 835,877, March 29, 1938. Blending acrylate or methacrylate resin with cellulose acetobutyrate or cellulose propionate and casting foils from the solution.

RESINS FOR TEXTILES. E. I. du Pont de Nemours and Co. British Patent 503,513, July 5, 1937. Condensing formaldehyde with unsaturated amides, e. g., methacrylamide, to form hard, tough, colorless resins which are useful in impregnating textiles or paper.

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Materials of Construction, 5th Edition

by A. P. Mills, H. W. Hayward, and L. F. Rader
Published by John Wiley and Sons, Inc., 440 4th Ave., New York, 1939

Price $4.00 **564 pages**

This textbook covers the manufacture, properties, and uses of the common materials of engineering construction with particular emphasis on modern materials and conceptions. It is divided into eight sections as follows: 1. Definitions of terms; 2. Metals; 3. Cementing materials (gypsum, lime, etc.); 4. Concrete and stone; 5. Brick, clay, refractory, and heat-insulating materials; 6. Timber; 7. Bituminous materials; 8. Organic materials. The two latter sections are new to the text and, in addition, a considerable portion of the book has been rewritten in the course of the preparation of this fifth edition by Dr. Rader.

The section on "Organic Materials" is made up of chapters on "Organic Protective Coatings" and "Organic Plastics" ably prepared by Dr. Wm. H. Gardner. The composition and selection of paint, varnish, and lacquer for different purposes are discussed in the former chapter and the classification, properties, and applications of the organic plastics are described in the latter.

G. M. K.

Kunstharzpressstoffe und Andere Kunststoffe, 2nd Edition

by Walter Mehdorn
Published by VDI-Verlag G.M.B.H., Dorotheenstr. 40, Berlin NW 7, 1939

Price: RM 15 **312 pages, 257 illustrations, 43 tables**

This revised and enlarged edition of Kunstharzpressstoffe (synthetic resin molding materials) includes both the thermosetting and thermoplastic materials within its scope. It is an excellent reference book for information on German plastics. Considerable emphasis is placed on the standard types, properties, and molding of the thermal hardening plastics. The organization of the subject matter, the abundance and excellence of the illustrations, and the quality of the paper employed are especially noteworthy. G. M. K.

Chemicals of Commerce

by Foster Dee Snell and Cornelia T. Snell
Published by D. Van Nostrand Co., Inc., 250 4th Ave., New York, 1939

Price $5.00 **542 pages**

This book is intended to serve as a guide to the composition and uses of common chemicals for business men and professional chemists. Its obvious value is primarily as a reference work for obtaining a general background of information regarding a particular chemical or group of substances with which one is unfamiliar. A comprehensive index of the products included in the text by both their chemical and trade names facilitates this use of the book. The information on plastics seems to this reviewer to be a little too sketchy and confused by being scattered through various chapters. An industrial rather than a chemical classification of these complex materials, such as was used for "Organic Dyes" and "Toners, Lakes, and Reduced Colors," would give a clearer "brief summary of plastics in commercial terms" which is one of the purposes of the book specifically mentioned in the authors' preface. G. M. K.

REPRINTS OF THE DIRECTORY SECTION OF MODERN PLASTICS, October 1939 issue, are available (Circulation Dept.) at $1.00 per copy. They include sources of raw materials, machinery and equipment; and list molders, fabricators, laminators and designers, complete with addresses of each.

Reprints of the Properties Chart are also available at 50c each. We mention these at this time because the October issue of the magazine has been entirely sold out.

BAKELITE CORP., 247 PARK AVE., NEW YORK, HAS issued an informative illustrated booklet on Bakelite Materials for Rubber Plate Printing, which points out the advantages of rubber plate printing, discusses phenolic resinoid matrix sheets and accessories and improved printing technique.

STANDARD MACHINERY CO., PROVIDENCE, R. I., HAS issued a new bulletin-catalog which illustrates the various foot presses made by the company. These presses are used for piercing, punching, forming, drawing and riveting work of all kinds.

A NEW PAMPHLET SHOWING IN COLOR SOME BATHrooms and kitchens in which laminated plastics have been used on the walls has been published recently by Formica Insulation Co., Cincinnati, Ohio.

"STOKES COMPLETELY AUTOMATIC MOLDING MAchines" is the title of a 16-page catalog issued recently by F. J. Stokes Machine Co., Philadelphia. Besides picturing automatic presses, the booklet tells an interesting story of the economies of automatic molding using case histories to illustrate the savings achieved in several plants.

CARBIDE AND CARBON CHEMICALS CORP., 30 E. 42nd St., New York, has issued its 1940 price schedule on Vinylite resins series *V*, *A*, *Q* and *X* and vinyl adhesive solutions.

GEORGE GORTON MACHINE CO., RACINE, WIS., HAS recently issued a 24-page illustrated booklet describing in detail numerous accessories, cutting and grinding tools, mills, jib boring tools, precision tracing styles, etc., which can be used with cutting and grinding machines.

THE LECTURE PROGRAM RELEASED BY THE METROpolitan Museum of Art for February–May, lists many interesting sessions for those interested in almost any subject of design. Courses of lectures by Miss Grace Cornell embrace Interior Design, Materials of Decoration, and Furniture. Miss Cornell also conducts short courses in Design and Color. These talks and lectures are planned for adults and are given in the Main Building of the Museum, except one series at The Cloisters. Copies of the program are available upon request.

HOW TO OBTAIN MAXIMUM RESULTS IN PAINTING interior and exterior surfaces on all types of tanks and supporting structures—how to quickly estimate surface areas and paint requirements—general instructions for application of finishes, etc., are explained in a folder recently published by American Asphalt Paint Co., 43 E. Ohio St., Chicago, Ill.

SECOND EDITION OF ITS HANDBOOK OF BUILDing Maintenance has been issued by Flexrock Co., 2300 Manning St., Philadelphia. Increased technical data and information for saving costs and obtaining better results in floor repair, concrete work and building maintenance are amply supplemented by diagrams and illustrations.

WRAP-RAX TAPE, AN IMPROVED COVERING FOR electroplating racks is described in a new bulletin issued by Hanson-Van Winkle-Munning Co., Matawan, N. J. A synthetic thermoplastic resin in tape form, it is claimed to be resistant to all cleaning, pickling and plating solutions commonly used, including chromium and bright nickel, and to contain nothing to contaminate the solution.

3 NEW COMPOSITIONS

developed exclusively for

BUFFING PLASTICS

•

LEAROK No. 436
for cutting down

LEAROK No. 746
for cutting and coloring

LEAROK No. 766
for color buffing

These three different grades of Learok are along lines entirely new to the art of polishing and buffing, yet logical for the plastic industry.

Lea Technicians, who have been and continue to be so helpful to the metal-working industry, are now spending much of their time on plastic polishing and buffing problems. In placing trial orders, please give details as to the kind of plastic being finished and the operations now being carried out.

THE LEA MFG. CO.
WATERBURY, CONN.

Specialists in the Production of Clean-Working Buffing and Polishing Compounds

For Heavy Duty PREFORMING

•

The Stokes No. 280

•

To make large preforms economically, pieces up to 4" dia., you need a No. 280 Stokes Toggle-type Press, the press that requires surprisingly little power to apply pressures up to 80 tons.

The popularity of this press is shown by a growing list of installations . . . by repeat orders . . . more than 40 of this one model are now in use.

No. 280 was designed to withstand heavy overloads . . . has a rugged, semi-steel frame . . . and other parts of exceptionally sturdy construction.

Its toggle action is smooth in operation. Variable speed drive saves power. Clutch and brake are instantaneous in action. An Excess Pressure Release absorbs shocks, prevents jamming.

Two models, 2" and 4" die fill.

Let us tell you more about the advantages of this press . . . also the other twelve sizes and types of Stokes Preform Presses.

F. J. STOKES MACHINE CO.
5934 Tabor Road Olney P. O. Philadelphia, Pa.

Representatives in New York, Chicago, Cincinnati, St. Louis, Cleveland, Boston
Pacific Coast Representative, L. H. Butcher Co., Inc.

F.J.Stokes FJS Est 1895

News

THE RECENT SUBSTANTIAL REDUCTIONS IN THE prices of triethyl citrate and tributyl citrate plasticizers announced by Chas. Pfizer & Co., Inc., should greatly extend the field of their usefulness, limited heretofore by their greater cost as compared to the more commonly used plasticizers.

These esters are solvent plasticizers for most plastic and film-forming materials. As is usually the case with esters of the same acid, the ethyl ester is more water sensitive and more volatile than the butyl; however, both compare quite favorably in these respects with corresponding esters of other organic acids.

Both esters are useful as plasticizers for nitrocellulose lacquers. Triethyl citrate is particularly interesting for this purpose because of its oil-resistance; for lacquers for outside use its water-solubility is a drawback. This, however, tends to give greater flexibility to coatings for inside use. The low volatility of tributyl citrate should make it of particular interest for such products. Films containing either ester have been found to be extremely resistant to yellowing by light.

As a rule, triethyl citrate has a greater solvent action on plastic materials than the butyl ester. Both, however, have been found to be plasticizers for cellulose ethers and esters, phenolic resins, polyvinyl acetal resins, and other polymerized products.

Acetyl triethyl citrate and acetyl tributyl citrate plasticizers, prepared by acetylation of the corresponding citric esters, are now available at prices which should render them of interest to all manufacturers of plastics and lacquers. These esters have much the same plasticizing properties as the unacetylated esters, and are in addition much lower in volatility and water sensitivity.

Acetyl triethyl citrate has shown particular promise as a plasticizer for cellulose acetate, being much less volatile and water sensitive than esters commonly used with this plastic. Acetyl tributyl citrate should be of especial value in lacquers because of its extremely low volatility.

GROWTH OF PLASTICS MANUFACTURE INTO A BROAD industry that now is providing jobs for hosts of workers and has given American consumers a seemingly endless variety of new and useful articles, was pictured recently by Dr. C. M. A. Stine, vice president of E. I. du Pont de Nemours & Co., as a direct offspring of the American organic chemicals industry.

When recently he was presented with the Perkin Medal of the Society of Chemical Industry for "valuable work in applied chemistry," Dr. Stine told how plentiful supplies of organic chemicals had made possible the comparatively recent development of the plastics industry.

Dr. Stine pointed to plastics as an example of how the organic chemicals industry "has not only provided jobs directly for thousands of workers, but also has indirectly opened up countless additional thousands of new jobs by providing the chemicals which have contributed to the development of new industries."

THE SECOND OF AN IMPORTANT SERIES OF EDUCAtional meetings sponsored by Bakelite Corp., unit of Union Carbide and Carbon Corp., was held in the Lecture Hall at Franklin Institute, Philadelphia, on Tuesday evening, February 13, in connection with the Bakelite Plastics Travelcade, which is installed at the Institute.

G. V. Sammet, Northern Industrial Chemical Co., gave a brief résumé of the growth of the plastics industry since the early days, previous to 1910, when there were only two plastic molding materials. He traced the introduction of new compounds their reduction in price, their increasing importance to industry, their expansion in opportunity and the company research which has so improved their physical properties and moldability.

Mr. Sammet introduced the first speaker of the evening: L. K. Merrill, head of the Research and Development Group of Union Carbide and Chemical Co., who spoke on Vinylite resins and Injection Molding.

Mr. Merrill was followed, after an introduction by Mr. Sammet, by Chas. A. Norris, of the Bakelite Corp. who spoke about up-to-date developments in Bakelite molding materials. This included phenolic, urea, cellulose acetate, and polystyrene. Mr. Norris illustrated his talk with lantern slides showing the new Plastics Comparator, worked out by Clint Blount of the Bakelite Corp., to illustrate graphically the physical properties of the various plastic materials so an easy, sure selection can be made.

The first meeting in this series was devoted to Protective Coatings for Industry and occurred on January 30.

The third and final meeting of the series will be held March 12 at the Franklin Institute and will be devoted to resin-bonded plywoods and improved laminated materials. D. J. O'Conor (Formica Insulation Co.) and George Meyercord (Haskelite Corp.) will be the speakers.

George Baekeland vice president of Bakelite Corp., will preside as Chairman.

A. SAUER & CO., RECOGNIZED FOR MANY YEARS for its contributions to the strap industry, claims to be the first to make and present to the trade the plastic buckle and keeper as a watch strap attachment. This development was prompted by a desire to make the perfect watch strap. The many new and attractive straps placed on the market by this company during the past few years were climaxed by the production of the now popular tubular designs. While these tubular styles made leather straps the accepted watch attachment, the metal buckle was still a hindrance. Perspiration and the acid condition of the individual wearing the strap soon corroded the buckle. When the corrosion reached the pin bar, it hardened the leather to such an extent that the strap broke at that point long before the leather was worn out.

After months of experimenting with various materials, the plastic buckle was found by the company to be the perfect product. It is available throughout the U. S. and in foreign countries under the trade name *Kon-ile*. The attractiveness and durability of this buckle together with the fact that it is said to be corrosion-proof, make it the perfect attachment for the modern watch strap. The buckles (pictured above) are made in a variety of colors to match or harmonize with the straps. The plastic buckle holds first place in the strap industry today, it is claimed, and its popularity is expected to continue. (*Please turn to next page*)

WE'RE PROUD OF OUR *Prizes* BUT YOU'RE THE REAL *Winner*

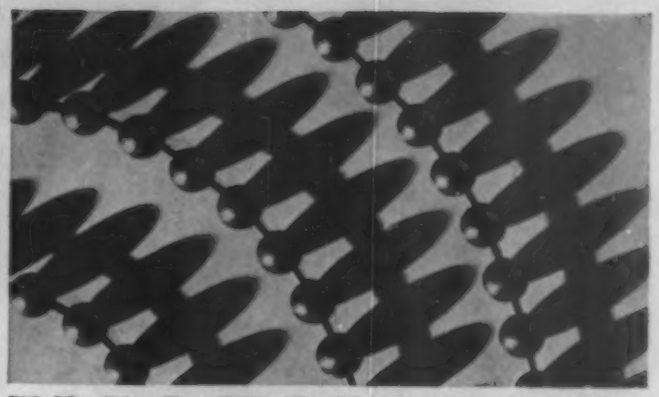
To Auburn has gone recognition of many kinds for jobs well done—the latest, two awards in Modern Plastics' annual competition. The articles that won these prizes are probably unlike any of your products—but the molding experience, care and skill that made them prize winners can be applied with equal profit to any product.

For more than 60 years Auburn has been turning out molded plastic products of all types—many of them pioneering jobs. Of all these millions of pieces taken from our forms, one story can be told—each and every one measures up to the highest profit winning standards of quality, workmanship, and precision.

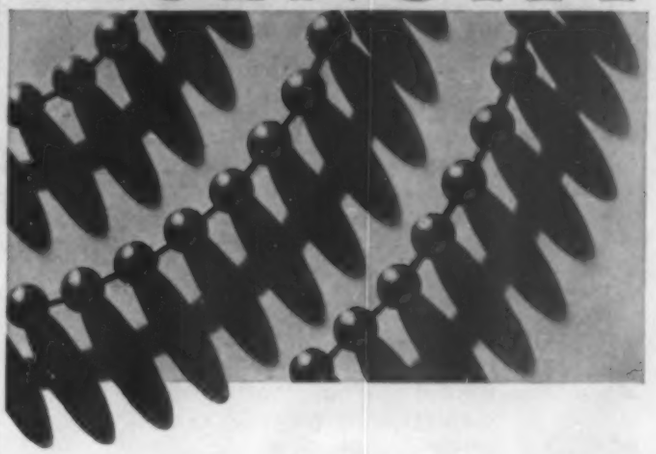
Illustrated above is the Bausch & Lomb Balar (3X Binocular), one of two top award winners in Modern Plastics' 1939 competition which were molded by Auburn.

ESTABLISHED 1876

MOLDED PLASTICS DIVISION OF
AUBURN BUTTON WORKS, Inc.
AUBURN, N. Y.—New York, Chicago, Detroit, Cleveland, Syracuse, Boston



INGENUITY



BEAD CHAIN*

It cannot kink nor tangle

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It is smooth and strong

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Made in many metals, including "Monel"

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A variety of plated and natural finishes

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In sizes from 3/32 to 3/8 inch diameter beads

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Ingeniously adapted to a great many products

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With over 25 years' experience we are prepared to cooperate with manufacturers and designers in developing practical assemblies of BEAD CHAIN* for their products.

BEAD CHAIN
ESTABLISHED 1914
Trade Mark Reg. U.S. Pat. Off.

THE BEAD CHAIN MANUFACTURING CO.
*Reg. U. S. Pat. Off. 60 MT. GROVE ST. BRIDGEPORT, CONN.

Displamor Exhibit Lounge in which you can display your products to visitors at the N. Y. World's Fair 1940 for as little as $350.00 for the entire season, with no extras. Close-up (below) shows how Sengbusch used such an exhibit at the Chicago Fair

THE NEW YORK WORLD'S FAIR 1940 IS PRESENTING A new exhibit plan to advertisers providing for product display space through its specially created Displamor Division.

Displamor exhibits (pictured here) will be installed in the major buildings and consist of 3-dimensional displays, many of them animated. This medium was soundly tested at the Chicago Fair and is in fact the result of a demand for similar display advertising space at the World's Fair 1940, which prompted officials to inaugurate it here.

According to Harvey D. Gibson, Chairman of the Board, World's Fair Corporation, locations are being rapidly taken up by a number of advertising agencies on behalf of their clients both here and out-of-town.

The purpose of this plan is to permit advertisers with limited appropriations to participate in the World's Fair in 1940. It also affords an opportunity to large exhibitors to augment their main exhibit with supplementary displays.

1. Your own 3-dimensional exhibit approximately 6 feet high by 3 feet wide; containing a recess about 6 inches deep to permit display of actual product or dioramas.
2. The Fair Corporation builds, decorates, and installs your exhibit; *there is nothing for you to build.*
3. All exhibits are glass enclosed, illuminated moving displays.
4. The Fair Corporation provides light and power maintenance; *there is nothing for you to maintain.*
5. Your folder with return coupon or order blank right at your exhibit. Attendant sends coupons or orders to you promptly.
6. Your display would be in one of the luxurious new Displalounges installed in a main exhibit building.
7. Each exhibitor receives a World's Fair Certificate of Participation.
8. Each exhibitor receives a World's Fair season ticket.
9. Privilege of using Fair emblem on letterheads, stationery, and promotion material is extended each exhibitor; cut is provided for this purpose.

Inquiries should be directed to Carl Schreiner, Displamor Division of the New York World's Fair.

TENNESSEE EASTMAN CORP. ANNOUNCES A REDUCtion in the price of Eastman cellulose acetate, both A (flake) and E (granular) types, and cellulose triacetate (flake). The price on all is currently 33 cents a pound, f. o. b. Kingsport, with transportation allowed by lowest rate to destination in the United States and Canada on quantities of 100 pounds or more. A list incorporating the new prices is available for distribution. The prices of the mixed esters remain unchanged.

J. EARL SIMONDS, PLASTICS CONSULTANT REPORTS that his office is now located at 58 Beauvoir Place, Summit, N. J.; telephone, Summit 6-2225.

A NEW AND IMPORTANT ADDITION TO THE POWERhouse at the Bound Brook plant of the Calco Chemical Division of American Cyanamid Co. now nearing completion which will increase ground area to 20,000 square feet. (*Please turn to page 84*)

DRUMMING UP BUSINESS!

The drummer boy, an example of Universal Custom Molding, is out drumming up business for several Universal customers, just as hundreds of other finely molded, completely assembled plastic moldings—or combinations of plastics and other materials—are doing for hundreds of other leading firms.

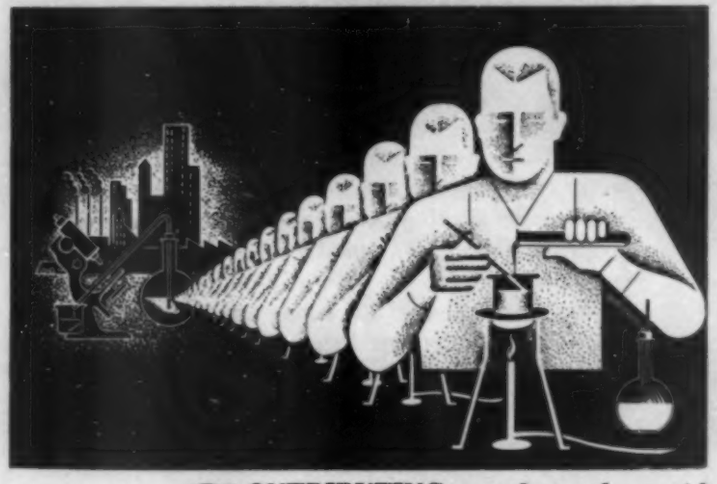
SERVICE means that our entire plant, INCLUDING COMPLETE ASSEMBLY, is as much at your SERVICE as our custom molding department, our mold-making section, in the production of your plastic product. Let OUR plant be YOUR plant!

UNIVERSAL PLASTICS CORPORATION

Custom Molders

Factory: 235 Jersey Ave.
New Brunswick, N. J.

New York Office:
500 Fifth Avenue



DU PONT
REG. U. S. PAT. OFF.

RESEARCH

Here's what it means

TO THE Plastic Industry

CONTRIBUTING greatly to the rapid rise of Plastics has been the creation of essential raw materials at prices which permitted their widespread use. Research by du Pont and other enterprising manufacturers made possible dependable uniform chemicals of highest quality thereby relieving a worrisome problem in Plastics manufacture and operation. Research has made available other and newer products at economic prices, and allowed the industry to develop and expand into many new and profitable fields of application for Plastics.

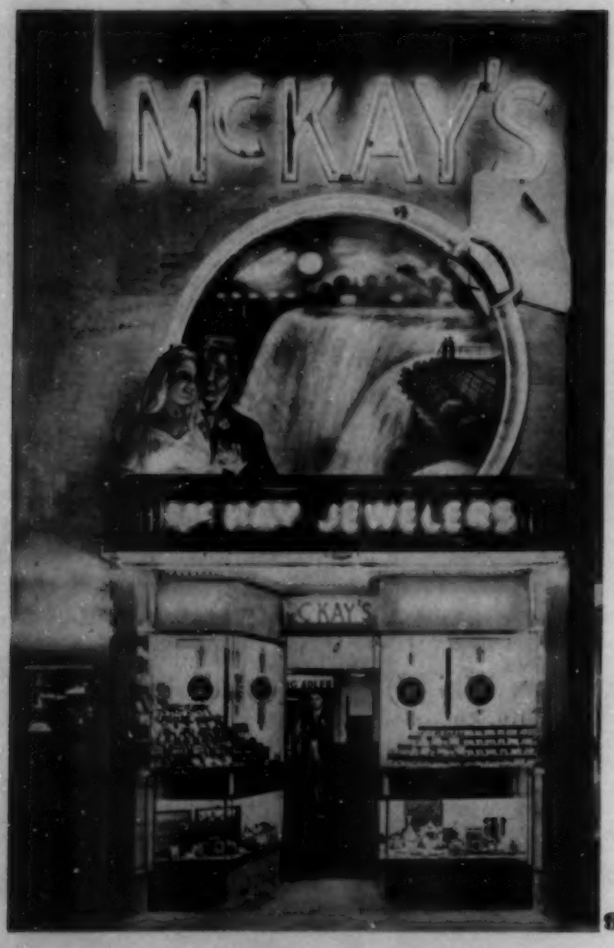
The "Cavalcade of America" Broadcast Every Tuesday Evening at 9:00 (E. S. T.) NBC Coast-to-Coast Network.

DU PONT
REG. U. S. PAT. OFF.

The R. & H. Chemicals Department
E. I. DU PONT DE NEMOURS & COMPANY (INC.)
Wilmington, Delaware

District Sales Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, Newark, New York, Philadelphia, Pittsburgh, San Francisco

8



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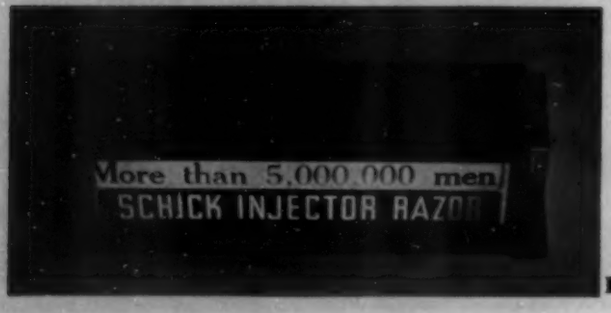


10

ILLUMINATED SIGN DISPLAY

(*Continued from page 27*) holes punched through a metal sign and lighted from behind. But they wouldn't light up effectively. Plastic buttons, though, were found to be perfect in light absorbing qualities. Both cast resin and methyl methacrylate rods are machine lathed to the required shape—usually about the size of the last joint of your small finger. They are in all colors and of transparent material with a frosted finish for an evenly distributed lighting effect with low electrical power, almost the same principle as a frosted bulb.

The Lauv-Lite Corp. has patented the methyl methacrylate button which locks itself into the perforated metal background of the sign. The buttons are ground with a maximum variation of .005 of an inch, and since the material has the advantage of no appreciable expansion or contraction, it has proved a practical outside application. There is no discoloration and the buttons last indefinitely.

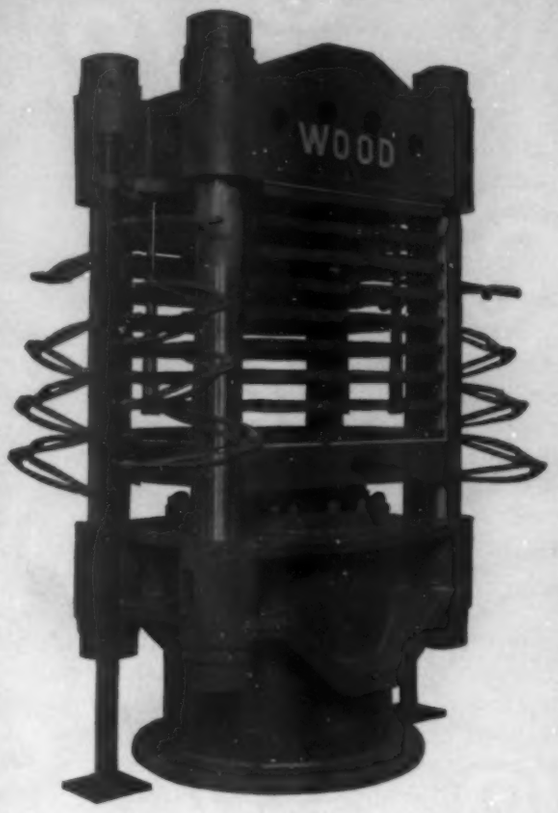
The greatest virtue of the plastic button sign, however, is low cost. Though the original manufacturing cost of this sign averages only 10 percent lower than gas-filled tubing (except, of course, in mass production where as high as 50 percent saving is possible) the maintenance cost represents considerable economy. Electrical bills are as much as 60 percent lower. The *Tropical* sign (Fig. 6) which is 30 ft. long, 90 sq. ft. in all, with 354 lineal feet of illuminated copy requires only 720 watts to light it.

The U. S. Royal sign (Fig. 7) for interior display has utilized a yellow cast resin button in an enameled metal background. The buttons are held in place with speed-assembly nuts. Perforated porcelain and composition wood backgrounds are also used. For a change of sign copy, the buttons can be extracted easily and fitted into a new backing thereby proving its flexibility. In painting the sign, a small rubber cup is made to fit over the buttons.

For a stunning, and if I may use the word, sophisticated sign in the *smart shop* category there are some marvelous potentialities in acrylic resin sheets. Not even paint is necessary. The copy can be routed, etched, or sandblasted on the reverse side of this *more-transparent-than-glass* material and fluorescent lighted from any one polished edge. The light, hidden in the base or background, follows the curve of the surface and only becomes perceptible where that surface has been cut or etched, while the exposed edges form a glowing frame for the entire sign.

If the emphasis is on the third dimension, thick strips of the acrylic can be bent into letters with one edge

Light from a concealed source outlines the edge of these Plexiglas letters **8** advertising La Salle, Buick, Pontiac cars. Lumarith sheet material pictures Niagara Falls **9** in this moving display for McKay's of Los Angeles. The Schick Injector Razor sign **10** with its illuminated message on running tape is housed in a molded Bakelite cabinet made for Crystal Fixture Company



HYDRAULIC PRESSES FOR THE PLASTICS INDUSTRY

Some presses that would be considered as "special" by others, are to be found in the standard line of the R. D. WOOD CO. Be sure to consult us regarding your press requirements.

(Above) An 8-opening, steam platen press operating on 2000 lbs. per square inch working pressure. Platen size—40" x 40".

(Left) A 50-ton Hydro-Lectric steam platen press with self-contained pumping unit. Pumps, motor, valves and piping are fully enclosed.

ESTABLISHED 1803

R. D. WOOD CO.

PHILADELPHIA, PA.

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE

THE SHORT CUT From Rough to Finished Job

Using the 3-M METHOD For FINISHING PLASTICS

. . . a quick easy way of removing flashings or gates and surface irregularities, making a better base for final polishing out. Eliminates dust and fire hazards.

USE THIS COUPON

MINNESOTA MINING & MFG. CO.
Saint Paul, Minnesota Dept. MP340

Gentlemen:

I will be interested in learning more about the 3-M Method.

I am finishing the following materials:.....

Name.....

Address.....

City..... State.....

embedded in an opaque background behind which are fluorescent lights (Fig. 8.). Then either the exposed edges or sides of the letters may be frosted for an unusual effect. Since acrylic resin softens when it gets too hot, fluorescent lights have been found safer than incandescent which might heat up and soften the embedded edge of the material.

Scene-in-Action displays—signs showing airplanes that appear to be flying, clouds that seem to roll by, and fires so realistic they seem to crackle, have of late depended upon a transparent cellulose acetate sheeting for practical and economical production. The scene is painted on a sheet of the acetate with opaque and translucent paints of varying shades. This sheet is attached to a frame by many springs which act as a curtain stretcher to keep the *shield*, as it is called, taut. Behind the shield are cylinders of the same material which revolve from the energy of the heat generated by the electric bulbs within them. The cylinders are painted with weird markings so that the light, in shining through them as they turn, gives the picture on the shield the appearance of motion. McKay's jewelry store in Los Angeles has the scene-in-action Niagara Falls within a neon wedding ring. (Fig. 9). The Falls fairly roar with gushing water, and the clouds seem to float past a harvest moon giving a non-too-subtle connotation of marriage. The cellulose acetate cylinder is more economical than curved glass. In flat sheets, however, the plastic is a trifle more costly than window pane glass, so its use on the shield is made practical for another reason—shipping.

But plastics are not always the illuminated element of the sign. They serve as insulation and make good bases and frames for the copy.

For instance, there are the numerous molded phenolic and urea bases into which glass with etched copy is inserted and lighted from within the base. They are exclusively indoor signs, and the molded base has replaced glass, wood or metal in such mass quantities as to prove economical as well as more beautiful. The Schick Razor travel-sign (Fig. 10) is included in a molded phenolic frame offered as a stock item by a Chicago display house. A ribbon on which the copy has been printed rotates in the lighted case and the entire display is light in weight, easy to ship and neat in appearance.

Some of these molded frames and bases serve a double purpose in not only enclosing the light and holding the copy, but by being illuminated themselves and made of a translucent urea, their pastel shades serve as immediate attention-getters for the copy.

The Krueger sign (see MODERN PLASTICS, July 1939, page 36) illustrates this with a multiple part frame around the top and both sides of the rectangular glass on which the copy has been printed. The effect of the light from within this tubular frame literally *makes* the display, and for the sake of variety, the two semi-cylindrical sides of the frame can easily be changed to a different color from the top. Or for that matter the entire set-up, color, copy and all can be altered with practically no trouble.

And so we see that paradoxically enough plastics are expensive and at the same time inexpensive, but, that like any quality merchandise, the satisfactory use in the long run more than compensates for the original cost.

THERMAL CONSIDERATIONS AND CONTROL IN MOLDING PLASTICS

(*Continued from page 54*)

Heat transfer in injection molding. Injection molding has been designed primarily for the molding of thermoplastic materials, which are forced through a nozzle and suitable gates into molds that are tightly closed together. Practically all of the recently developed injection molding machines are designed for fully automatic operation, and close attention has been given to the heat transfer problems incurred therein. Unlike compression molding where the material is plasticized by the temperatures upon the molding surfaces, the material in injection molding must be fed into a plasticizing chamber where it is heated to molding temperature before injection. The high temperatures employed will not permit the molding material to remain in this state for too long a period, otherwise burning or decomposition will occur. The success of the process depends upon close cycle control, wherein a constant output rate must be maintained for a given heat input to the plasticizing chamber. Though thermoplastic materials will not set up like thermosetting materials after short exposures to high temperatures, nevertheless they may not be maintained at the molding temperatures for an indefinite period of time, as they will tend to decompose, burn, discolor or lose their desirable molding qualities.

In analyzing heat transfer problems in injection molding, one must analyze the flow of material from the time it leaves the hopper feed to its entrance into the injection mold cavities. It is the practice to chill the loading end of the plasticizing chamber and the bushing for guiding the injection plunger with cool water. The cooling water is usually circulated by the same pump that circulates cooling water to the molds. Following the loading entrance is the main portion of the plasticizing chamber where the materials are brought up to the molding temperature and forced through a nozzle into the mold by the injection plunger. In order to improve upon the heat transfer from the walls of the plasticizing cylinder to the material, a spreader (sometimes called pineapple or torpedo) is employed to reduce the cross section of the material to a very thin layer when it passes the main heating surface. In this manner the material is brought rapidly up to the molding temperature as it flows and makes intimate contact with the heating surfaces. All the recently designed injection molding machines make particular efforts to control this temperature accurately by means of suitable temperature responsive elements, one usually being mounted in the walls of the plasticizing cylinder, as close to the material as mechanically

PUZZLED

about plastics?

See American Insulator—they'll tell you if you can do it in plastics. They'll tell you which plastic is best for the job. They'll design it—skillfully—so as to cut waste and loose ends. They'll make a mold to produce it—accurate to a hair.

They'll mold it on their battery of high-speed, modern compression and injection presses. They'll finish it to specifications. And they'll do all this rapidly and economically and very, very well.

If you're puzzled about plastics—any phase of plastics, SEE AMERICAN INSULATOR.

Our design department will gladly offer advice without obligation.

American Insulator Corp.

Plant · NEW FREEDOM · PENNSYLVANIA

SALES OFFICES:

BOSTON, BUFFALO, CHATTANOOGA, CHICAGO, CLEVELAND, DETROIT, LOS ANGELES, ST. PAUL, STRATFORD, NEW YORK, PHILADELPHIA, ST. LOUIS

Write for FREE 48-page book giving basic plastics data.

We specialize in
MACHINES for CELLULOID, CATALIN and other PLASTIC MATERIALS

Bench Saw Tables . Jig Saw Machines . Rod Turning Machines for Beads, etc. . Hand Lever Presses . Gold Inlaying Machines . Electric Steam Heater Tables . Single and Multiple Spindle Drilling Machines . Shaping Machines . Frazing and Engraving Machines

No. 1 Electric Steam Table

ALSO DIES . TOOLS . MOLDS

Dies for Injection Molding

New England Representative for the line of Lester Injection Molding Machines.

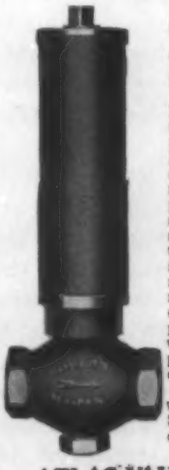
STANDARD TOOL CO.
73-75 WATER STREET
LEOMINSTER MASS.

6000 LB. Pressure!

ATLAS

TYPE "E"

Reducing Valve



In Successful Service in a Number of the Leading Plastics Plants.

For Working Pressures up to 6000 Pounds Without Shock. Forged Steel Body. For oil as well as water and air. Truly modern in every respect. Internal metal parts entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

We make regulating valves for every service. See partial list in the coupon at the right.

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☐ Please send complete information on the Atlas High Pressure Reducing Valve.
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City.....State.....

feasible, and the other close to the injection nozzle. Heating units in both locations are controlled individually by their respective thermal responsive elements. How close the molding material attains the temperature indicated by the instrument has been open to some question, because of the thermal properties of the material being heated. The plastics are relatively good heat insulators and a temperature gradient is bound to exist away from the walls, though if the material is thinned out by the spreader, much better results can be obtained. Extension of the thermal responsive elements away from the walls into more intimate contact with the molding material has its drawbacks for mechanical reasons, and by offering an obstruction to the flow of the material through the plasticizing chamber. However, custom molders know from experience that for certain temperatures on their indicating thermometers, they are able to mold certain pieces satisfactorily, and hence guide themselves on a comparative basis.

It is probable that considerable time is required before the concentric spreader within the plasticizing cylinder attains temperatures approaching those on the walls of the plasticizing chamber. This is true for injection molding machines which rely upon external heating units in the form of resistance coils, or indirect electrical heat through a circulating hot oil fluid medium. The heat must flow from the walls of the plasticizing chamber to the spreader by conduction. Some measure of success however, has been attained by one manufacturer of injection molding machines who employs a magnetic heating method, utilizing the hysteresis loss in the steels of the plasticizing chamber and spreader, as caused by a strong alternating current field, to build up the molding temperature.

Flow Through Nozzle. To improve the plastic flow conditions and make up for loss of heat when contacting the nozzle adaptor on the molds, the injection nozzle is usually provided with additional heating coils which are automatically controlled with respect to temperature. Temperature responsive elements are placed as close to the material as feasible. The operations of the injection molding machine are timed so that the contact of the hot nozzle with the relatively cool molds is made as short as possible, to avoid chilling the nozzle and hence freezing a long stem of molding material that may have to be cleared out of the way before another shot is made.

Material as It Enters the Mold. If a discrepancy exists between the temperature readings of the instruments outside the plasticizing cylinder and the molding material, what then is the temperature of the material as it enters and flows through the mold, where the heat is very rapidly transferred to the relatively large cool mass of the mold surfaces? Inasmuch as only a few seconds are required to chill the material in the molds to a low enough temperature to permit ejection of the molded articles, from a practical standpoint the material temperature in the mold can only be expressed as a gradient. A rough integrated measure of this gradient would be the chilling time and the ejection temperature of the piece. The writer has been able to evaluate the nature of this temperature gradient in some injection molds which employ large metal inserts about which the molding material flows. This is accomplished by coating the metal insert with thin layers of materials that will be softened by the molding material. The layers should be thin enough so that the mass of this surface is small with respect to the mass of the molding material. In some instances a hard colored sealing wax has been satisfactory, the coating disappearing entirely in the vicinity of the gate, where the molding material would be expected to be the hottest, and gradually assuming shape the further away the material is from the gate entrance, as the molding material is cooled down. Flow patterns of the molding material may also be studied on this coating over the insert. In one case under examination, approximately $^1/_{12}$ of the mold surfaces attained for a very short period a temperature sufficient to flow away the wax coating (melting point 217 deg. F.), while the rest of the surfaces was not melted by incoming molding material. This indicates the rapid cooling which occurs down the nozzle adaptor and the gates. At the time of injection the temperature of the molding material in the plasticizing chamber was observed to read 400 deg. F. on the instrument.

Consequently, from a temperature measurement viewpoint, injection molding has many problems due to the complex nature of the heat transfer elements from the time the material enters the plasticizing chamber to the time it is ejected as a molded article. While the attainment of certain temperatures in the plasticizing cylinder have been shown to be highly important to the success of fully automatic operation, the molder must not lose sight of the significance of the temperatures of the material in the nozzle and the molds themselves, for good molding is often dependent upon the plastic behavior of the material in these regions.

PLASTIC FOR INTERIOR DESIGN

(***Continued from page 39***) John Eberson has specified these flush type doors (Fig. 11), laminated with wood on fireproof cores, for many theater lobbies. Kick plates and push plates of $^3/_{32}$ to $^1/_8$ in. thick sheets, withstand terrific abuse and do not require laborious polishing and the surface stays new.

Highly resistant to alkalies in washing solutions, laminated plastics were employed for walls in the Rialto barber shop, New York (Fig. 12), where frequent cleaning is necessary to retain a fresh, sanitary and bright appearance.

Wherever interior applications call for surface beauty and permanence, laminated plastics are inherently right for prime consideration. Also for modernization and renovation—laminates are easily applied over old surfaces. In any plan of decoration, these versatile, practical materials allow endless variations of the designers and architect's art—the individual, the conventional, the ultra-modern.

Rely on Kurz-Kasch for Plastics

If your next plastic part must appeal to the eye—smooth, shapely and smart—call on Kurz-Kasch, a leader in plastic styling.

Or if it's practicality you require—a molding that must serve without being seen—rely on Kurz-Kasch to design it and mold it for faithful and faultless performance.

Kurz-Kasch is one of the nation's largest exclusive molding plants. The problems we haven't met and mastered are few and far between, whether it's in plastic parts selected for beauty . . . or heavy duty.

WRITE describing the problem, product or package you have in mind.

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Alloy Cast Steel One Piece Main Frames

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Massive Construction For Withstanding High Pressures

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Easily Accessible Fill and Pressure Ajustments

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Simplified Punch and Die Mounting for Quick Set-Ups or Change-Overs

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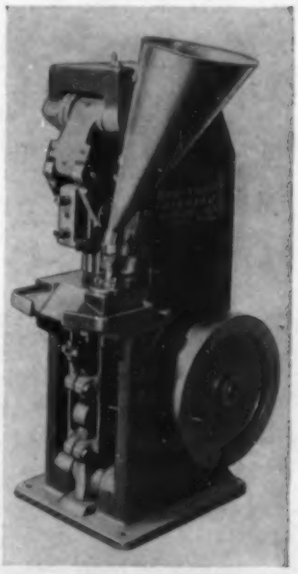

Single Punch—Pouse Type

KUX-LOHNER MACHINE CO

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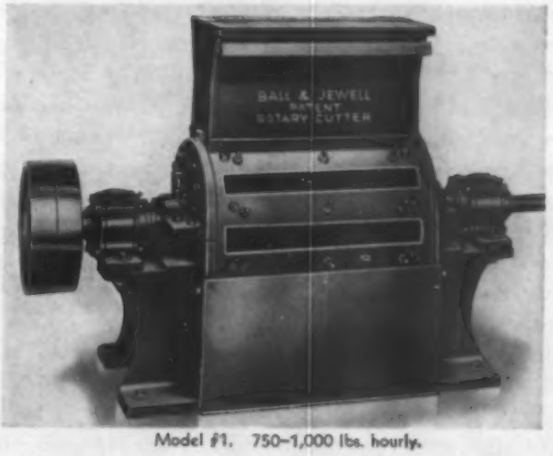
BALL & JEWELL ROTARY CUTTER SAVES OWN PRICE; CUTS WASTE



Model #1. 750–1,000 lbs. hourly.

The Heavy Duty Model #1 shown, grinds 750 to 1,000 pounds of scrap per hour. Turns gates, flash, sprues, rejects into usable molding powder. Cuts material waste down near the zero mark!

So efficient is this machine, and so useful in your plant, that you will find it saving its own purchase price in a very short time. Ball & Jewell Patent Rotary Cutters come in 11 sizes, adapted to every requirement, from 25 to 2500 lbs. per hour. Write for *free* catalog.

BALL & JEWELL

20 Franklin St. Brooklyn, N. Y.

Inventors and Manufacturers of the first Patent Rotary Cutter in 1895

TWO ASPIRINS PLEASE

(*Continued from page 37*) of cavities, must be accurately machined to measurements of thousandths of an inch. They must be positioned so that their outline is identical in both halves of the mold. They must be hard enough to withstand the pressure required to force plasticized material into every crevice and contour of their surface—not once, but a million times or more, depending upon the quantity of identical parts to be molded in each cavity.

They must be channeled so accurately that steam, hot water, or electricity may supply the exact amount of heat required at each point of the mold to plasticize and cure heat-hardening material; or to permit cold water to continually chill the mold when heat-softening materials are molded by the injection method.

Ribs and other strengthening devices must be planned and engineered into the construction of the mold so the finished parts will not warp or distort when relieved from their molding pressure. Provisions must be made for holding inserts which are to be molded in, and more frequently than not, bosses and threads must be molded into the finished piece to facilitate assembly.

Molds for injection machines must provide proper gates and sprues for the material to enter—just the right amount of material, and at the proper speed to obtain perfect flow to every part of the mold before the material begins to chill. And it chills rapidly in a well-cooled mold. Furthermore, the mold must be capable of quick opening and closing in automatic production without excessive wear at any one point. It must be able to eject the molded part without sticking or loss of press time.

Imagine then, if you can, what took place in the engineer's mind when he set out to build the dies for this endless chain (Fig. 1), molded of cellulose acetate by the injection method. There are 39 right-angle turns for the material to make before it begins its circular path to squirt links of the molded material into a perfect chain. In their molding position, none of the links touch each other, yet with the simple expedient of breaking each link from its individual gate (where the flash or bonding line is exceedingly thin) a succession of sixteen links results in a continuous chain which requires no other finishing operations than assembly as bag handles or jewelry parts.

Before dismissing this thought lightly, remember that no undercuts can appear when the mold is open for ejection, or it would be impossible to get the parts out. Remember, too, that the injection press is turning out chains at the rate of eight to ten each minute of the day; working, probably, on three 8-hour shifts.

If you look at the photograph carefully you can see that each link of the chain is injected at right angles to its immediate neighbor, which permits the completed links to be interwoven and inseparable. No molding material is injected into the chain at either end.

Chains of this sort were formerly made from extruded rods—cut, then bent to shape by heating and cemented together with a material solvent. Hand work with little assurance that each link would resemble its companion in more than general appearance. By molding chains with the injection method, hand work is almost entirely eliminated and a more perfect and far less expensive product results.

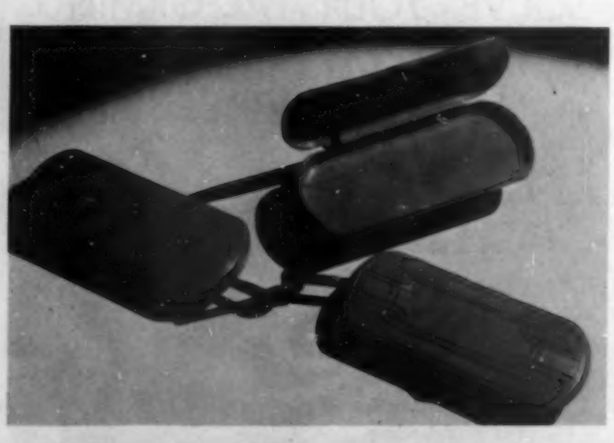
Manufacturers who complain that tools and dies cost too much, usually base this opinion upon their evaluation of a certain amount of money rather than upon the value of service this money will return to them in production. They have been known to balk at the expenditure of a thousand dollars in advance of production, even in the knowledge that they might save ten times that amount if their production runs into a million parts or more.

Injection molds seldom cost that much, however, because a smaller mold is capable of more rapid production with fewer cavities per mold. That is one of the reasons why injection molding has advanced so rapidly during the past three or four years. Even with higher costs of molding compounds required for this type of production, the cost of finished parts is often favorable by comparison with compression molded parts in which less expensive compounds are used.

In the beginning (three years ago) injection machines were not available which would turn out parts of more

Produced in one injection, both halves of the engraved spectacle case **2**, after removal from the sprue, are attached by molded hinges. Fastening pins are inserted through tiny holes positioned to fit perfectly. From a scientifically planned mold, tooth brush handles are ejected twenty at a time **3**, ready for assembly with a minimum of hand work

2



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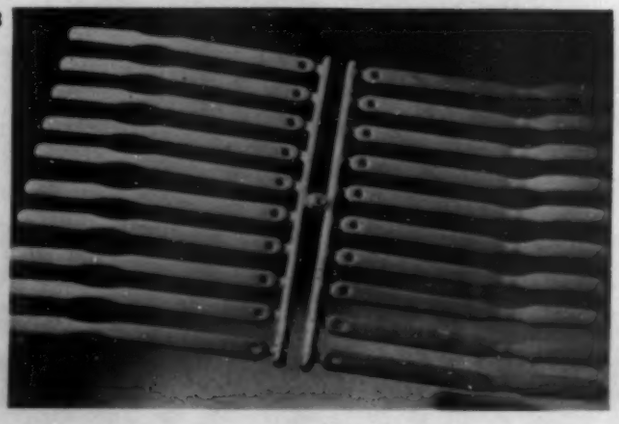

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. . . . that give greater strength to finished plastics.

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More than 20,000,000 lbs. of Claremont flocks have met exacting requirements over our 24 year existence.

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Now you can vary the pressure in an Elmes Air Ballasted Hydraulic Accumulator simply by moving a small lever on a control panel. You can quickly and easily increase or decrease the pressure as needed.

This new improvement saves a vast amount of time, labor and expense and speeds up plant operations. Other advantages of the Elmes Pistonless, Air Ballasted Accumulators are: (1) line shocks eliminated; (2) much less space required than with weighted accumulators; (3) no special foundations needed; (4) uniform pressure maintained by correct ratio between air and liquid; (5) no internal packing; no internal moving parts.

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than 2 oz. in weight per injection. Today, it is possible to inject as much as 32 oz. each time the press closes. This has enabled molders to accept assignments for parts of greater area and weight wherever heat-softening plastics are suitable to the application.

Mold makers, however, those chaps who figure out how it can be done, have contributed their share of inventive genius, knowledge and experience. So have the manufacturers of injection machines. Otherwise, acetate chains would still be made by hand and injection molding would be limited to very small parts.

Another salutatory example of the mold maker's art may be seen in the spectacle case shown in Fig. 2. Through a single sprue the compound flows to mold the upper and lower halves of the case, both of which are engraved with decorative surfaces, in a single injection. The hinges are so accurately positioned that when the two halves are broken from the sprue and placed together, they fit precisely. The thing you can't see, and which the mold maker had to figure out in advance, are the tiny holes through each hinge section which aline perfectly to accommodate the pin that holds them together. These holes are molded in place by flowing the material around a thin core, afterward withdrawn.

Modern tooth brush handles are injection molded, twenty at a time. Fig. 3 shows how it is done. Handles are shaped and polished with the head of the brush tilted at the exact scientifically planned angle, and the recessed holes are already in place and polished when ejected from the press. The only finishing operation required (other than bristling) is to break the handles from their individual gates and touch them lightly to a polishing wheel at the point where they are broken off.

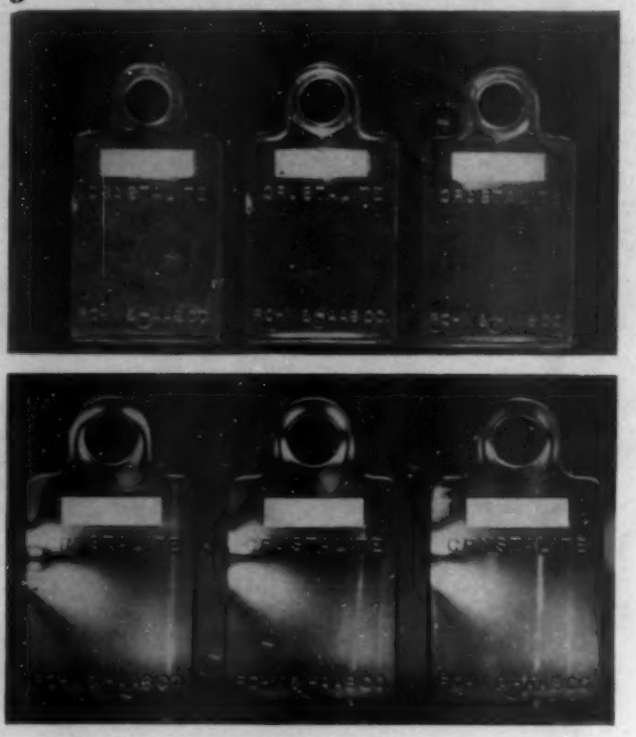
We could go on and on with our applause for the maker of molds. We could dig up many more difficult examples than we have chosen to show. But we only want to point out that the mold maker's skill is highly essential to the successful molding of plastic parts. He has a passionate enthusiasm for working out what appear to be hopeless problems and he has the ability to make plastic compounds perform as he desires whether they like it or not.

If you still hold to the opinion that molds cost more than they are worth, then just try to whittle one out of solid steel that will produce a plastic chain like the one pictured here. The aspirins are ready whenever you need them.

SERVICE TEMPERATURE FLOW CHARACTERISTICS OF PLASTICS

(*Continued from page 49*) their elastic property, combined with the molding conditions, and their relatively high coefficient of expansion, cause stresses to be set up within the material. This happens in any of the methods of molding but most particularly in so-called "injection" molding. At the top of Fig. 9 are shown three injection-molded pieces. At the bottom these same pieces are shown as observed in polarized and analyzed light. The presence of internal stresses is revealed because the material is photoelastically stress-sensitive. The stress concentration around the injection gate will cause a permanent deformation at this spot if the piece is heated to the temperature at which these stresses equal or exceed the flow resistance of the

9



10

Above—**9** injection-molded pieces photographed as received, by natural light (top) and by polarized light (bottom) to show internal stresses. Below—**10** same pieces after heating 100 min. at 170 deg. F. photographed similarly, show disappearance of stresses as a result

DON'T MOLD

—until you check costs with this economical method!

If it's round and small, make it on an automatic screw machine from Ameroid Rods—and save expensive mold charges. Ameroid is easily turned, threaded, drilled and polished. Non-inflammable.

Ameroid Casein Plastic Round Rods are available from stock in a large range of plain colors, also Black and White. Ground to desired diameter from ¼" to ¾", inclusive, and as small as 1/16" to order.

If you are not equipped to turn the parts, experienced fabricators will do it economically. Write for samples of radio parts, knobs, bushings, fishing reel handles, etc., made on screw machines with Ameroid Round Rods.

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When it's "Life or Death" for Your Product-

Why wait for the emergency? A new design now will act as a sales stimulant; will open up new markets; will bring in new profits. Stokes designers have put many an old product on its feet and started new products on successful careers. Sooner or later you'll find out that "Designed by Stokes" means designed for selling. Call us in on your next molding job.

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material. At the top of Fig. 10 these same pieces are shown as they appear in natural light after they have been heated for about 100 min. at 170 deg. F., while in the view at the bottom the use of polarized light has revealed the fact that most of the internal stresses have been relieved by this treatment.

A measurement of the recovery deformation could be combined with data on the constant stress-strain characteristics of the material to determine the actual stresses formerly existent in the material. It is not at all unusual to observe stresses which are capable of causing dimensional deformations of 10 percent within the service temperature range. A somewhat exaggerated case of this sort was noted in a cylinder 1 in. in diameter and 1 in. long which was compressed to about 84 percent of its original height by a stress of 12,000 psi at 20 deg. C. (68 deg. F.). On being heated to 100 deg. C. (212 deg. F.) this piece recovered to about 93 percent of its original height. Obviously, this might void the piece for its intended use. Such difficulties can often be avoided by taking into account the possible effects of such stresses and devising changes in the molding technique which will minimize their formation.

It is hoped that this discussion will encourage further laboratory and practical experimentation with thermoplastic resins with the view of obtaining more complete data of real value to the plastics engineer and designer.

SMALL RADIOS

(*Continued from page 31*) First, by coordinating his two factors of design. By insisting that his product designer discuss his plans with the molder who is to do the job before any definite approval is given.

In doing so, his designer will be able to create a cabinet design that will meet the strict limitations of good molding technique and one that will not suffer in service later on.

By the same gesture, the molder will be able to incorporate by suggestion certain requisites for molding and assembly that will reduce the eventual cost of the cabinet without any sacrifice of the substantial qualities which assure permanent and satisfactory performance.

Second, by viewing with suspicion any quotation which is substantially lower than the average of others submitted from identical plans and checking it carefully, either with a material manufacturer or a molding engineer from a neutral source. Such quotations are usually the result of errors in mathematics or in judgment and almost invariably prove costly to someone before the job is completed.

Another thing which will avoid disappointment in the operation of molds is to definitely determine in advance whether cabinets are to be molded of phenolics or ureas and build the mold accordingly.

A manufacturer will decide sometimes to mold a new cabinet in black or brown, let us say, for which a phenolic material is chosen. Later, he changes his mind and decides to add a few ivory or pastel shades to the line and urea material is specified to turn them out.

Perhaps the urea will mold without trouble in the same mold. And perhaps it won't. Both materials are plastic and are molded by compression, but there is enough difference in their chemical and physical make-up to demand certain differences in mold construction to make them flow properly.

A mold built to accommodate urea material will usually handle phenolic without difficulty but it doesn't always follow that a mold designed to handle phenolics will turn out urea moldings without alteration.

It isn't necessary to go into the details of these differences here because if the manufacturer is frank in discussing his plans with the molder, he will know how to build the mold so it will work either way.

Must the manufacturer or designer delve into the chemistry of plastics to determine their suitability to his product?

No! The molder, besides his own engineering and manufacturing experience, has at his disposal the laboratories of a considerable number of plastic material manufacturers which are manned by the best research chemists and engineers in this country.

These men devote their lives to the improvement of plastics. They are constantly alert to every sort of failure exhibited in products made from their materials. Each is a specialist in his own particular field.

In a recent visit to one of these laboratories, I discovered dozens of cabinets which had been dipped in a special dye that revealed every flow line of the material as it had been molded. Every little line was visible in a perfect pattern and each cabinet showed identical flow lines, which proves that the flow of the material in every molding takes the same prescribed path without any deviation.

Therefore, if one cabinet cracks or opens up at some weak point, every cabinet is subject to the same deficiency if exposed to similar conditions no matter how many are made.

Alone, this discovery might not be important were it not for the fact that by studying these flow lines it is possible to change their course to strengthen weak spots in future designs. This may be done by changing the design before production begins or by designing the mold so that the material will flow freely where it must travel some distance before it welds after a separation. And these colored flow patterns indicate how this can be done. That, of course, is but one test.

More interesting and perhaps more important, is the aging test which enables the laboratory technicians to make suggestions in engineering design which point out where molds should be streamlined instead of having sharp corners or edges that are responsible for the weakness in the molded piece.

Generally speaking, the laboratory confines its efforts to discovering weaknesses and pointing them out to the sales engineers of the material manufacturing company, which in turn makes the information available to molders using its materials.

In going about this aging test, the molded cabinets

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BY THE NEW, ECONOMICAL
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No heated equipment or drying ovens required.

By developing special inks and special equipment, we have met the plastic industry's demands for practical machines and chemical inks for printing on plastic surfaces.

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Let us show you how . . . and how much . . . you can benefit by using this system.

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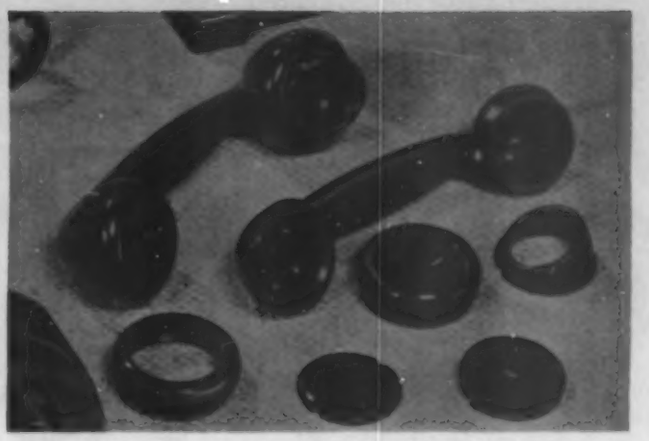

An example of a difficult transfer* moulding by Northern for the Connecticut Telephone & Electric Corp.
Meriden, Conn.

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*LICENSED UNDER SHAW PATENTS FOR TRANSFER MOULDING

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PLASTIC SPECIALISTS FOR MORE THAN 25 YEARS

YARWAY
HYDRAULIC VALVE

GREATER EASE AND FLEXIBILITY OF CONTROL

THE HIGHER THE PRESSURE THE TIGHTER THE VALVE

AUTOMATICALLY REGRINDS OWN SEALING SURFACES

LONG TROUBLE-FREE LIFE
LOW MAINTENANCE

QUARTER CENTURY OF SUCCESSFUL USE

Made in straightway, three-way and four-way types — Write for Bulletin H-2-C

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PLASTIC CURING
Like Boiling Eggs . . .

With timed application of a known heat, hard centers are assured. But in plastic molding you don't have the temperature constant . . . the boiling point of water. Mold temperatures should be checked frequently. The Cambridge Mold Pyrometer offers an easy, quick and accurate means of checking every cavity in the mold.

Combination and Single Purpose Instruments

Cambridge Instrument Co., Inc.
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CAMBRIDGE
Mold, Surface and Needle
PYROMETERS

Bulletin 194—S gives details of these instruments. They help save money and make better plastics.

or other pieces are placed in closed compartments with carefully regulated temperatures. In the beginning, the piece remains for 48 hours at saturated moisture conditions at 85 deg. F., just a warm summer day's temperature.

After 48 hours the pieces pick up a certain amount of moisture and swell. Then they are put into a dry compartment at 125 deg. F. which causes them to lose the moisture and shrink. If there is any failure in the design, they will crack. It is believed that this test is fairly accurate since the cracks induced by this method are in the same relative position as are the cracks that occur in service, where radios are kept in steam-heated apartments where the heat goes up and down and the plastic cabinet expands and shrinks.

Actual tests of this sort cannot be made, of course, until the mold has been made but so many cabinets have been subjected to the tests and so many existing designs have been studied that material manufacturers can render invaluable service to the molder and radio manufacturer based upon this experience. Errors of the past need not be committed in the future if radio manufacturers will take advantage of the knowledge and experience which already exists for their benefit.

The outstanding conclusion reached through these laboratory tests is that if simple precautions are taken in the beginning to avoid creating conditions which plastic materials cannot be expected to meet, radio cabinet trouble will disappear. And the sale of plastic sets will enjoy a tremendous advance with increasing profits to manufacturers and satisfaction to users.

It is our firm conviction that many of the difficulties encountered in radio cabinets could be overcome if the artist who draws the design would (1) consult the radio man whose parts are going into the cabinet; (2) consult the man who is going to carve or make the mold; and (3) consult frankly and fully with the man who is going to supply the plastic material.

FROM A TO Z

(*Continued from page 36*) (1 in. high) which covers four grooves; and a regular size for general purpose (3/4 in. high) which covers three grooves.

The choice of color at the present time is red and white—a red that never fades but keeps its rich, bright hue no matter how much it is handled or how long it sits in the sun; a white that is easy to keep clean and shining. Neither will chip, dent nor break.

There are accurately molded figures, too, for the right-hand side of the menu. Though we seem to have concentrated on menus, the molded plastic letters and figures, of course, aren't confined to this medium alone.

Compression molded urea and phenolic letters are used to make novel, professional-looking titles of attractive design and high legibility. Letters may be set on any matte black, scenic or colored background for artistic contrasts. The accuracy of outline and thickness of the characters create striking shadow effects.

Another manufacturer is using molded figures for

Besbee Product Corp.'s alphabet for making movie titles shown in its folding case (top photo) is molded of Bakelite and Plaskon by Universal Plastics Corp. Illuminated house numbers and base of the Sentinel (lower photo), are of Bakelite molded by Chicago Molded Products Corp., for Peerco, Incorporated

out-door house numbers. Electrically illuminated by a device which is attached to the doorbell circuit and economically operated, the plastic numbers can be easily identified at night by visitors or messengers.

Colorful, lightweight, long-wearing and easy-to-handle, these versatile molded plastic alphabets spell out their own future—and the range of applications is almost without limit.

HIDDEN HANDLES

(*Continued from page 32*) are reinforced at strategic points by molded ribs and thickened cross sections for added strength and shock-resistance. There are no sharp edges to tear clothing or mar adjacent furnishings. The hard, smooth surface of the plastic is readily cleaned, as it is unaffected by water, oil or organic solvents, will not fade and color is permanent.

The interest in this combination of steel and molded plastic lies not alone in the successful matching of color and material. For those who question the comparative wearing qualities of plastics versus metal, this singular application should prove an ideal test piece—both materials will have to stand up under similar conditions. The versatile qualities which determined the selection of the plastic material and molding precision offer a fair prognosis that the plastic can satisfy the demand.

GRIND 200 Lbs. OF SCRAP PER HOUR with the RAPID PLASTIC GRANULATING MACHINE!

Or use its smaller size and get 100 lbs. per hour! Simple in design, rugged in construction, these machines render efficient service for years on end. Best alloy steel is used for their blades and cutters. Spindles are made of high tensile alloy steel, hardened and ground, and mounted on Timken Roller Bearings.

Each machine comes with two different sized screens, 3/8" and 3/4", interchangeable in two minutes . . . and with underneath chute to carry granulated plastic to basket.

Investigate these money-saving machines now. Write for folder and full information.

LEOMINSTER TOOL CO., Inc.

272 Whitney St. Leominster, Mass.

Mfrs. of complete line of equipment for Catalin, Celluloid and Plastic Molding AND INJECTION MOLDING DIES.

FOR PLASTIC PRODUCTS

Here is an opportunity to purchase a practically new

150-ton

BUSCH SULZER DUO PRESS

(Four Available)

AT ABOUT 25% OF THE ORIGINAL COST

Purchased by Us

From the

GRIGSBY-GRUNOW COMPANY

Manufacturers of

MAJESTIC RADIOS

Consists of two presses in one, having a heating station and a cooling station with a table which is revolved about a central column to transfer the molds from one station to the other.

We would be pleased to arrange shipment of these units to responsible companies for trial.

Louis E. Emerman Co.

1761 Elston Avenue Chicago, Illinois

CONTRACT AND CUSTOM

PLASTICS MOLDING

FOR THE TRADE

INJECTION MOLDING

A SPECIALTY

Ask us for QUOTATIONS on your requirements. No obligation.

WRITE TODAY

S. S. WHITE

The S. S. White Dental Mfg. Co.

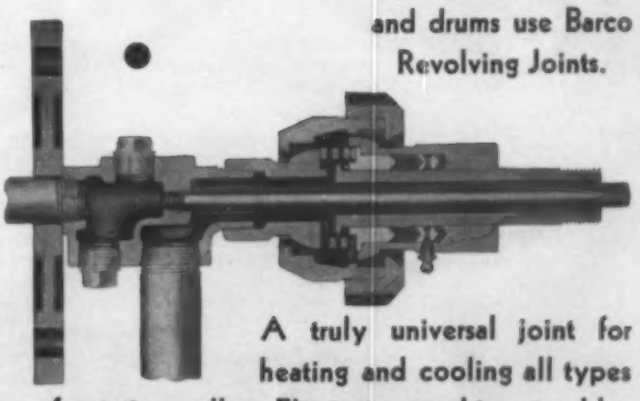
INDUSTRIAL DIVISION

PLASTICS DEPARTMENT M

10 East 40th St., New York, N. Y.

BARCO

For efficient operation of revolving rolls and drums use Barco Revolving Joints.



A truly universal joint for heating and cooling all types of rotating rolls. Eliminates packing troubles due to strains in ordinary stuffing boxes.

Barco Manufacturing Co.

1813 Winnemac Avenue

CHICAGO, ILL.

In Canada: The Holden Co., Ltd.

CLASSIFIED

Sales Representative wanted by old established Eastern custom molder of a wide variety of Plastic Products to work on a strictly commission basis. Reply Box 338, Modern Plastics.

●

PACIFIC COAST SALES ORGANIZATION: Offering comprehensive and intelligent coverage of manufacturers, wholesalers and retailers in this important area. If you are looking for additional business for stock mouldings or other plastic products we invite correspondence. If you desire aggressive and dignified representation on a commission basis we believe we can give you co-operation and worthwhile results. ROTH & HARE, 559 S. Broadway, Los Angeles, Calif.

●

PLAINVILLE, CONNECTICUT—FOR SALE or LEASE! Modern Brick Factory Building—25,000 sq. ft. of floor space. Oil burning heating system—automatic sprinklers and other modern equipment—additional storage building—ample land for future expansion—good labor center—conditions most favorable for manufacturing requirements. Herbert F. Fisher, Agent, 983 Main St., Hartford, Conn.

●

WANTED: Stainless Steel or Nickel Kettle, Vacuum Pan, Hydraulic Press, Preform Machine and Mixer. Reply Box 275, Modern Plastics.

●

FOR SALE: Watson-Stillman Hydro-Pneumatic Accumulator, 8″ ram, 48″ stroke, 42″ air cylinder, 5000 lb. PSI, complete with high pressure air receiver and interconnecting fittings; 2 Watson-Stillman 4-cylinder opposed Hydraulic Pumps, 6000 lb. PSI, 25 GPM, motor driven, 100 HP AC motors; 7 Gould Triplex Hydraulic Pumps, 3 1500-PSI, 35-GPM, 4 3000 PSI, 18 GPM; 6-24″ × 24″ Hydraulic Presses, 12″, 14″ rams; 2-30″ × 30″ Hydraulic Presses, 14″ rams; 60″ Mixing Rolls; 2-300 gal. Nickel Agitated Jacketed Vacuum Stills. Reply Box 339, Modern Plastics.

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FOR SALE: Plastic & Molding equipment. Rebuilt and Guaranteed. Large stocks Hydraulic Presses, Pumps & Accumulators. Preform Machines, Rotary Cutters, Mixers, Grinders, Pulverizers, Tumbling Barrels, Drill Presses, Lathes, Gas Boilers, etc. Send for Bulletin #146 and #128. We also buy your surplus machinery for cash. Reply Box 335, Modern Plastics.

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PLASTIC MIXING & MOLDING EQUIPMENT—Factory rebuilt—Hot Rolls or Mixing Mills, Hobbing and Die Sinking Presses, Semi-automatic and Standard Molding Presses, Hydraulic Pumps, Accumulators, Intensifiers. Reply Box 294, Modern Plastics

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FOR SALE: F. J. Stokes DD, 6 Stokes D, Stokes B, Colton #3 ROTARY TABLET MACHINES: 3 Stokes E, Stokes F, 4 Stokes H, Stokes R, Colton #5, SINGLE PUNCH TABLET MACHINES: Hydraulic Presses, Weighted and Pneumatic; Accumulators; Dryers, etc. Air Mail for details. Reply Box 340, Modern Plastics.

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CHEMICAL ENGINEER with excellent business contacts seeks connection or capital for new plant to manufacture molding powders. Now employed in production of well-known plastic. Reply Box 341, Modern Plastics.

●

WANTED: CELLULOSE ACETATE SCRAP, unground or reground, as well as lumps, also acrylic or methacrylic resin scrap and celluloid scrap. Send details concerning quantities and price. Reply Box 318, Modern Plastics.

●

WANTED: New Plastic Molding Plant, manufacturing tooth brushes, sun glasses and combs requires thoroughly experienced superintendent with full knowledge of Reed-Prentice injection machines, polishing and adjusting of molds; experience in manufacturing tooth brushes preferred. Write full particulars in detail in order to obtain interview. Our employees are fully cognizant of this ad. Replies treated in strictest confidence. Reply Box 342, Modern Plastics.

●

Young man, 33, single, wishes Sales Position with Molder or Material Manufacturer. Engineering training, knowledge of blue prints, good salesman. Has adaptability. T. J. Gleason, 49 Hodge St., Buffalo, N. Y.

NEWS

(Continued from page 68)

THE PROPOSED S. P. I. CRUISE IN JUNE HAS BEEN cancelled because of insufficient reservations. Charlie Frantz and his Entertainment Committee are far from discouraged, however, and will announce the date and place of the Spring Meeting within two weeks.

COLUMBUS PLASTICS PRODUCTS, INC., COLUMBUS, Ohio, reports that it has appointed Felix A. Redlich as its New York representative with headquarters at 475 Fifth Avenue.

HYDRAULIC PRESS MFG. CO., MT. GILEAD, OHIO, has increased the space and facilities of its New York office, having moved to 233 Broadway. The telephone number remains the same—Cortlandt 7-9066.

OTTO HANSEN, PRESIDENT OF CAST PLASTICS, INC., says the winner of the contest to choose a name for his new casting resin will be announced in the April issue of this journal. An award of $50.00 will be paid for the best name submitted before March 15. If you have a suggestion, just shoot it along to Cast Plastics, Inc., 200 Sussex Ave., Newark, N. J.

A NEW, EASILY PREFORMED, HIGH-IMPACT PHENOLIC molding material has been announced by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. This molding compound, known as Durez 1900 Black is said to deliver an unusually smooth finish for a standard high-impact type, and to be unique in its particle size and shape through which it is given its excellent preforming properties. The particle size is so controlled that the material flows through hoppers and automatic feeding devices easily. For this reason it is reported to be suitable for many parts requiring a high-impact material which had previously been considered impractical for molding.

BRIDGEPORT MOLDED PRODUCTS, INC., IS INSTALLing five additional Standard automatic presses in its plant at Bridgeport, Conn. "We find ourselves in need of additional equipment" says Jas. E. Berthold, president of the company, "and from our experience in operating the original Standard automatic press for some months now, we are in a position to know that this press offers many economies. It is a decided improvement over conventional hand molding."

THE PLASTICS DIVISION OF THE GORHAM CO., PROVIdence, R. I., has been discontinued and the plant is being dismantled. No official reason for the decision has been released.

GINO F. DORNFELD, CASILLA DE CORREO, 1591, Buenos Aires, would like to represent an American manufacturer of synthetic resins for varnishes in Argentina. He states that he has been working in this field many years with real results and desires to contact a firm capable of satisfying a large demand.

SORRY—

ON PAGE 30, FEBRUARY ISSUE OF MODERN PLASTICS, we pictured Styron and Ethocel building blocks and said they were manufactured by Dow Chemical Co. We have since learned that these blocks were molded by Thermo Plastics, Div. of Standard Products Co., from materials supplied by Dow.

In picturing the Rock-Ola automatic coin phonographs on page 66 in our February issue, we said that "almost the entire front of the cabinets are cast phenolic." It now turns out that most of the front of each cabinet is translucent Insurok made by The Richardson Co., Lockland, Ohio. The three top sections across the front are cast resin, so while there was an element of truth in our caption, we are sorry we lead you astray on the balance.